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Users Manual for Preparation of Air Pollution Isopleth Profiles and Population Exposure Analysis

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16. ABSTRACT

This report is a companion document to the "Guideline on Procedures for constructing Air Pollution Isopleth Profiles and Population Exposure Analysis (OAQPS No. 1.2-083)." It contains an overview of the analysis procedures and documentation for computer software. Three programs (SYMAP, Tricon and Hybrid) can be used to produce computer - drawn maps for isopleth analysis. Two programs (LPEM and SPEM) are used for spatial interpolation and population exposure analysis.

17. KEY WORDS AND DOCUMENT ANALYSIS

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GUIDELINE SERIES

USERS MANUAL FOR PREPARATION OF AIR POLLUTION ISOPLETH PROFILES AND POPULATION EXPOSURE ANALYSIS

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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USERS MANUAL FOR PREPARATION OF AIR POLLUTION ISOPLETH PROFILES AND POPULATION EXPOSURE ANALYSIS

Monitoring and Reports Branch
Monitoring and Data Analysis Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

October 1977 1.a

OAQPS GUIDELINE SERIES

The guideline series of reports is being issued by the Office of Air Quality Planning and Standards (OAQPS) to provide information to state and local air pollution control agencies; for example, to provide guidance on the acquisition and processing of air quality data and on the planning and analysis requisite for the maintenance of air quality. Reports published in this series will be available - as supplies permit - from the Library Services Office (MD-35), Research Triangle Park, North Carolina 27711; or, for a nominal fee, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

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This Users Manual was prepared by Neil Frank, Monitoring and Reports Branch, Monitoring and Data Analysis Division, Office of Air Quality Planning and Standards, United States Environmental Protection Agency.

The computer programs contained in this manual were developed through the efforts of many individuals. Two of the computer programs, LPEM and SPEM were developed by Yuji Horie, Technology Service Corporation, Santa Monica, California. Conversion of LPEM and SPEM to the U.S.E.P.A. UNIVAC 1100 was made possible through the efforts of Jim Capel, Monitoring and Reports Branch. The computer graphics program, HYBRID, was developed by Neil Frank. The computer graphics program, TRICON, was developed by Martin Cohen, Technology Service Corporation. The use of the computer graphics package, SYMAP for the display air quality information was provided by the efforts of Margaret Swann and Jim Capel of the Monitoring and Reports Branch.

USERS MANUAL FOR ISOPLETH/POPULATION EXPOSURE TREND ANALYSIS

1.0 INTRODUCTION

This Users Manual is a companion document to the "Guideline on Procedures for Construction Air Pollution Isopleth Profiles and Population Exposure Analysis." The Manual contains an overview of the analysis procedures and documentation for computer software.

Three programs (SYMAP, Tricon, Hybrid) can be used to produce computer-drawn maps for isopleth analysis. Basic inputs to each program are digitized study area boundries, data values and spatial coordinates. SYMAP is a computer package which produces character printed maps on a line printer. Tricon and Hybrid are computer programs which produce maps on a CALCOMP pen plotter or a Textronix cathode ray tube display device. A description of these procedures is found in Section 2.4 of the Guideline document.

Two programs (LPEM,SPEM) are used in the analysis of population exposure and isopleth analysis. LPEM designates Long-Term Population Exposure Model, SPEM designates Short-Term Population Exposure Model. The programs establish long-and-short-term population exposure statistics. from air quality information obtained from a network of monitors. The details of these models are discussed in Section 3.3 of the Guideline document.

As an analysis procedure, the development of useable isopleth maps from exisiting air quality information is a necessary prequisite to the estimation of population exposure. From an operational point of view, however, the user may elect to first execute the population exposure programs prior to executing the computer graphics. This is because the population exposure programs offers some interesting features which are applicable to the development of an isopleth map. For this reason, the population exposure programs will be discussed first in this manual.

For each computer program, the manual will contain a general description of the run procedure, required data inputs with specified formats, operating instructions, sample input and sample output. For all programs except SYMAP, a source listing of the program statements is also provided.

The remainder of this report is divided into four sections which describe the analysis procedure and the computer software. The four sections are:

2.0 Overview of the Isopleth/Population Exposure Analysis

3.0 Estimation of Exposure
    3.1 LPEM: Long-Term Population Exposure Model
    3.2 SPEM: Short-Term Population Exposure Model

4.0 Computer Graphics
    4.1 HYBRID
    4.2 SYMAP
    4.3 TRICON

5.0 Program Listings

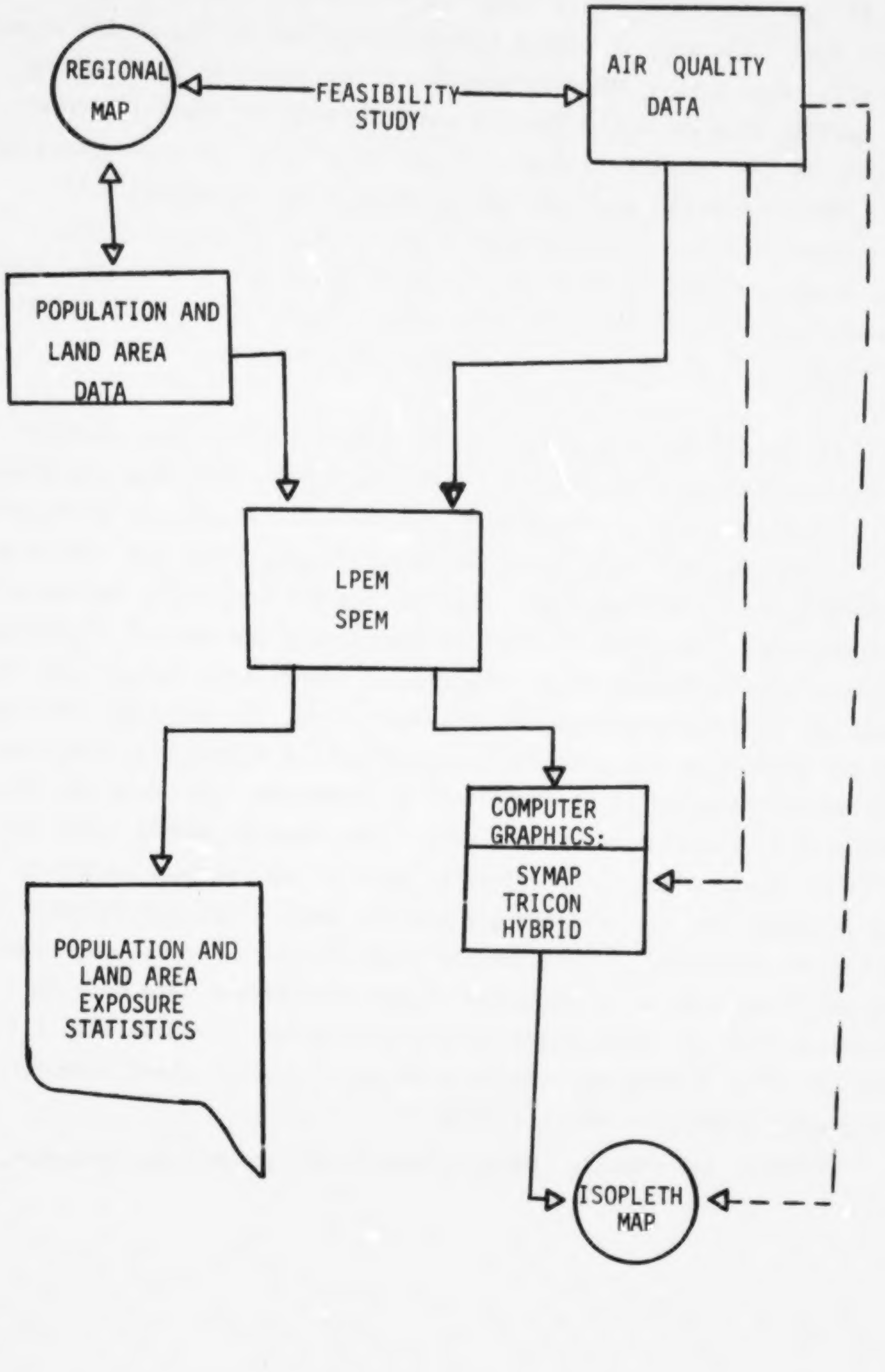
2.0 OVERVIEW OF THE ISOPLETH/POPULATION EXPOSURE ANALYSIS

The first step in the analysis is the selection of a regional map and air quality monitoring or modeling information for the proposed study area. The next step is determining the feasibility of the proposed analysis based on available information. This involves locating the air quality data points on the map and examining the spatial coverage, as well as the temporal coverage of available data. This investigation will yield tentative boundries of the study area and determine if air monitoring or dispersion estimates shall be used. Once these steps have been completed, a hand drawn isopleth map might be developed from the air quality information at this time. These items are discussed in Section 2.1, 2.2 and 2.3 of the Guideline document.

If population/land area exposure analysis or refined computer drawn isopleth maps are desired, then some additional steps are necessary. This involves setting up a network of artifical receptor or grid points of the regional map. For exposure analysis, population and land area information is also required. (See Section 3.1 and 3.2 of the Guideline.) The network of receptors is used to approximate the spatial distribution of population and land area. The spatial coordinates for air quality data points and receptor points are determined. In addition, the boundries of the study area are numerically specified. A Rectangular coordinate system with the origin at lower left is preferred. All data are then prepared as computer input data sets. The computer models, LPEM and SPEM calculate air quality values at each of the receptor points by interpolation from the existing air quality data. These estimated values serve two purposes. First, they provide the basis for estimating exposure. Second, they provide a convenient spatially refined data base for preparation of a computer generated isopleth map. (See Section 2.4 of the Guideline.) This map can be produced by one of three computer programs: SYMAP, TRICON or HYBRID.

Figure 2-1 shows a simple schematic of the analysis procedure.

FIGURE 2-1. SCHEMATIC OF ISPOLETH/POPULATION EXPOSURE ANALYSIS


REGIONAL MAP
FEASIBILITY STUDY
AIR QUALITY DATA
POPULATION AND LAND AREA DATA
LPEM
SPEM
COMPUTER GRAPHICS:
SYMAP
TRICON
HYBRID
POPULATION AND LAND AREA EXPOSURE STATISTICS
ISOPLETH MAP

3.0 ESTIMATION OF EXPOSURE

The computer programs, LPEM and SPEM, estimate exposure to air pollution by interfacing the spatial distributions of air quality, population and land area. The air quality information can be defined by a network of air quality monitors or an output grid from a dispersion model. The population and land area information is approximated by a network of artificial receptor points. Each point is used to represent a portion of the total population and land area. The programs estimate air quality values at the network of receptors by the use of an interpolation formula. Thus, a specific air quality value is associated with a particular population and land area; this establishes the exposure estimates. (See Section 3.3 of the Guideline.)

Both models require a variety of basic input data sets relating to the spatial distribution of the population density within the study region. These are specified by spatial coordinates of a receptor network, associated populations and land areas. Another basic input common to both models is the spatial coordinates of the monitoring sites. Concerning the air quality parameters from which exposure is established, LPEM uses average concentration at the network of stations, while SPEM is based on the use of percentiles of pollutant concentrations. As will be shown on the use of LPEM, it can also estimate short-term population exposure by using the percent of excursions above an air quality standard at each site (in place of average concentration).

3.1 LPEM Long-Term Population Exposure Model

A. General Description

Average concentrations are estimated at a network of receptor points form average concentrations at a network of monitoring sites. For each receptor, the program calculates the average concentration from the nearest 3 stations by the use of an interpolation formula. A penalty distance can be imposed to account for the influence of barriers such as mountains.

Once the air quality estimates are established at the receptor points exposure statistics are calculated for land area, total population and sub-populations (such as school age and elderly).

B. Input Card for Output Description

1. Title Card for output tables - Card 1
2. Parameter cards - Card 2,3
3. Barriers - When barriers are included, the following are required: One card for number of barriers and number of nodes per barrier. One card for each node and penalty distance associated with the node. Up to 20 barriers are allowed. Penalty distance is interpolated between nodes and is added to distance between receptors and monitors for spatial interpolations. If barriers are not used, no cards are needed.

4. Charcteristics of Statistical Areas - One card or record for each statistical area. (A statistical area is an area for which area and population data is defined. It contains one or more receptor points.) Each record contains a 2 part ID code for each statistical area, values for total area and up to 4 subpopulations expressed in percent. These values are optional and can be left blank. The first part of the ID code should be a sequenced index value for each area. The second part of the ID code is not used by the program, but can be used to specify a geographic subregion such as county for the users convenience. Up to 300 statistical areas are allowed.

5. Receptor Coordinates - One card or record for each receptor point. Each record contains a 2 part ID code and x,y coordinates for each receptor. The first part of the ID code should correspond to the number of the statistical area in which it resides. The second part of the ID code is not used by the program but can be used for the users convience. Up to 300 receptor points are allowed.

6. Number of Receptors per Statistical Area - One card is required for every 16 areas. Values may be zero, designating a statistical area excluded from the study, or greater than zero. Usual values are 1 for a single receptor per statistical area.

7. Site Coordinates - One card or record for each site. Each record contains a 2 part ID code and x,y coordinates. The first part of the 2 part ID should be a sequenced index variable, for each site. The second part of the ID code is not used by the program, but can specify a geographic subregion such as county for the users convenience. These records can designate the entire monitoring network even if a specific site did not produce any data for the analysis. Up to 200 sites are allowed by the program.

8. Concentration Data - One card or record for each site. Each record contains a 2 part site ID code and one air quality value (e.g., annual mean) for each year. Up to 7 years can be input on each record. Only records for sites with data need be included.

9. Population Data - One card or record for each statistical area. Each record contains a 2 part ID code for statistical area and a population value for total population and total employment. Employment data is optional and can be left blank.

NOTE: It is preferable that coordinate systmes be sent up so that origin is at lower left.

C. LPEM Input Data - List of parameters and record format description.

LPEM DATA ITEMS - all fields should be right justified.

It is not necessary to zero fill any fields.

Card Column	Variable Type	
1-78		1. Title Card - any parintable character can be used.
		2. Control Card No. 1 (input parameters)
1-5	I	NRECEP - No. of receptor points
6-10	I	NMONT - No. of monitoring stations with coordinates
11-15	I	NSITES - No. of monitoring stations with data ($3 \leq NSITES \leq NMONT$)
16-20	I	NRSA - NO. of statistical areas with population data ($NRSA \leq NRECEP$)
21-25	I	(not used)
26-30	I	NPOPL - No. of population classes such as school age, elderly (1 to 7) See Note.
31-35	I	NHOUR - 1 for hour data; 24 for 24 hour data (not used for LPEM)
36-40	I	NYEAR - No. of years of air quality data
41-50	F	SYEAR - Initial year
51-60	F	DELYR - Incremental year
61-70	F	AQSTD - Air quality standard
71-75	I	NPDIST - Penalty distance - if penalty distance is used, NPDIST = 1
		Control Card No. 2 (parameters for exposure distributions)
1-10	F	XLOW - Lowest concentration value
11-20	F	XINCR - Incremental value
21-25	I	NINCR - No. of increments

NOTE: If percent working population is included in Characteristics of Statistical Areas, then setting NPOPL = 6 will generate exposure information for workers at place of residence and non-workers at place of residence. If employment data is included in data item no. 9 (Population Data), then setting NPOPL = 7 will generate exposure information for workers at place of employment.

Card Column	Variable Type	LPEM DATA ITEMS
		3. Barriers
		First Card
1-2	I	Mountn - No. of barriers
3-5	I	MNODE (1) - No. of Nodes for barrier 1.
6-8	I	MNODE (2) - No. of Nodes for barrier 2.
...		MNODE (MOUNT) - No. of Nodes for "MOUNTN"
		Subsequent Cards
1-8	F	x (I,J): x coordinate of Jth node of Ith barrier
9-16	F	y (I,J): y coordinate of Jth node of Ith barrier
17-24	F	P(I,J): Penalty distance assigned to Jth node of I-th barrier
		4. Characteristics of Statistical Areas One record for each statistical area, I
1-10	I	IDRSA (I,1)-first part of 2 part identification code.
11-20	I	IDRSA (I,2)-second part of 2 part identification code
21-30	F	AREA(I)-land area of each statistical area
31-40	F	POPCNT(I,1)-percent of total population for sub-population class 1
41-50	F	POPCNT(I,2)-percent of total population for sub-population class 2
51-60	F	POPCNT(I,3)-percent of total population for sub-population class 3
61-70	F	POPCNT(I,4)-percent of total population for sub-population class 4

NOTE: If workers by place of residence is used, put this data item into sub-population class 4.

Card Column	Variable Type	
		5. Receptor Coordinates - One for each receptor point, I
1-10	I	IRECEP(I,1)-first part of 2 part receptor ID code
11-20	I	IRECEP(I,2)-second part of 2 part receptor ID code
21-30	F	RECEP(I,1)-x coordinate of receptor point
31-40	F	RECEP(I,2)-y coordinate of receptor point
		6. No. of Receptors Per Statistical Area - One record for 16 statistical areas
1-5	I	IRSA(1) - No. of receptors in Statistical area 1
6-10	I	IRSA(2) - No. of receptors in Statistical area 2
11-15	I	IRSA(3) - No. of receptors in Statistical area 3
.	.	
.	.	
.	.	
.	.	
.	.	
70-75	I	IRSA(15) - No. of receptors in Statistical area 15
76-80	I	IRSA(16) - No. of receptors in Statistical area 16
1-5	I	IRSA(17) - No. of receptors in Statistical area 17
.	.	
.	.	
.	.	
	I	IRSA(NRSA)-No. of receptors in Statistical area NRSA
		7. Site Coordinates - One record for each site, I parameters
5-10	I	ISITE(I,1)-first part of 2 part ID code
16-20	I	ISITE(I,2)-second part of 2 part ID code
21-30	F	SITE (I,1)-x coordinate
31-40	F	SITE (I,2)-y coordinate

Card Column	Variable Type	
		8. Monitoring Air Quality Data - One record for each monitoring site with data
		parameters
1-5	I	INSITE - first part of 2 part ID code
6-10	I	KSITE - second part of 2 part ID code
11-20	F	CM(INSITE,1) - air quality value for year 1
21-30	F	CM(INSITE,2) - air quality value for year 2
31-40	F	CM(INSITE,3) - air quality value for year 3
41-50	F	CM(INSITE,4) - air quality value for year 4
51-60	F	CM(INSITE,5) - air quality value for year 5
61-70	F	CM(INSITE,6) - air quality value for year 6
71-80	F	CM(INSITE,7) - air quality value for year 7
		9. Population Data - One record for each statistical area
		parameters
1-10	I	IDRSA (I,1)-first part of 2 part ID code for statistical area I
11-20	I	IDRSA (I,2)-second part of 2 part ID code for statistical area, I
21-30	F	POPL (I,1) - total population for statistical area I
31-40	F	POPL (I,2) - total employment for statistical area I

D. Sample Run Stream on UNIVAC for LPEM

```
@ ASG,A   TRRP*POPEXP
@ XQT     TRRP*POPEXP.LPEM               executable version of program
@ ADD     TRR*POPEXP.LPEM-DATA/NY        sample data

@ ELT,ISL  user file.element 1           saves monitoring air quality data
@ ADD 7.                          }      with x y coordinates
@ EOF                                    user file (OPTIONAL)

@ ELT,ISL user file.element 2            saves estimated air quality data at
@ ADD 8.                          }      receptor points with x y coordinates
@ EOF                                    on user file (OPTIONAL)

@ ELT,ILS user file.element 3            saves population density at receptor
@ ADD 9.                          }      points on user file
@ EOF                                    (OPTIONAL)

@ FIN
```

E. Description of Temporary Output Data Files Created by LPEM

1. Monitoring Air Quality Data with x y Coordinates - output on unit 7

The first record specifies the number of monitoring sites, n_1 with data for the first year of input data. The next n_1 records contain information for those n_1 sites. For each additional year of input data, the above pattern is repeated.

Column	Type	Record Formats Parameters	
1-3	I	No. of sites with data for specific year	- first record
1-10	F	Concentration value	one record for each site with input data for the year
11-20	F	X Coordinate	
21-30	F	Y coordinate	
31-40	I	Monitor number-first part of 2 part ID code	
41-50	F	Year	

2. Estimated Air Quality Data at Receptor Points with x y Coordinates - Output on unit 8

The first record specifies the number of receptor points, r, included in the analysis. The next r records contain air quality information for those r points. For each additional year of input data, the above pattern is repeated.

Record formats are the same as Monitoring Data.

3. Population Density at TReceptor Points - outputoon unit 9.

The first record specifies the number of receptor points r, included in the analysis. The next r records contain population density information for those r points. The population density is calculated by the program for each point that has a defined land area.

Record formats are the same as Monitoring Data.

F. Description of LPEM Output

1. Several tables are produced which describe the input data. These include characteristics of the statistical areas, population data, receptor specification data and air quality monitoring data. The yearly average of all stations is given.

2. For each year of input data, a table is provided with the interpolated/extrapolated concentrations at the receptor points.

3. For each year of input data, tables of exposure distributions are provided for total population and each subpopulation. Population class 1 refers to the total population and population class i refers to subpopulation i-1. Cumulative frequency distributions and frequency functions are provided for population and land area exposure. Population and land area weighted averages are also given. The value of the frequency distribution for air quality value D* is defined as the fraction of land area or people exposed to air quality values greater than or equal to D*. The value of the frequency function for air quality value D* is defined as the fraction of land area or people exposed to air quality values greater than or equal to D* but less than D* + increment. Increment is the difference between successive table values of D* as defined in the LPEM input.

```
                   LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

  NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  4
  NYEAR =    2    SYEAR =  1971.0     DELYR =  3.0     ARSTD =   75.0

 CHARACTERISTICS OF STATISTICAL AREAS

 NO.=   1   SA=    1   11    AREA =197.70   SUBPOP A,B,C,D (IN %) =   27.0    9.0    1.5    .0        RECEPTORS PER SA =  1
 NO.=   2   SA=    2   11    AREA =193.20   SUBPOP A,B,C,D (IN %) =   25.0    9.5    8.0    .0        RECEPTORS PER SA =  1
 NO.=   3   SA=    3   11    AREA =130.70   SUBPOP A,B,C,D (IN %) =   29.0   11.0    1.0    .0        RECEPTORS PER SA =  1
 NO.=   4   SA=    4   11    AREA = 85.90   SUBPOP A,B,C,D (IN %) =   27.0    8.0    1.5    .0        RECEPTORS PER SA =  1
 NO.=   5   SA=    5   11    AREA =127.60   SUBPOP A,B,C,D (IN %) =   31.0    6.5    1.5    .0        RECEPTORS PER SA =  1
 NO.=   6   SA=    6   11    AREA =130.70   SUBPOP A,B,C,D (IN %) =   29.0    9.0    1.5    .0        RECEPTORS PER SA =  1
 NO.=   7   SA=    7   11    AREA =158.90   SUBPOP A,B,C,D (IN %) =   31.0    8.0    1.5    .0        RECEPTORS PER SA =  1
 NO.=   8   SA=    8   11    AREA = 96.90   SUBPOP A,B,C,D (IN %) =   27.0    9.5     .8    .0        RECEPTORS PER SA =  1
 NO.=   9   SA=    9   11    AREA = 32.60   SUBPOP A,B,C,D (IN %) =   29.0   10.5    1.0    .0        RECEPTORS PER SA =  1
 NO.=  10   SA=   10   11    AREA = 32.60   SUBPOP A,B,C,D (IN %) =   29.0    8.0    1.0    .0        RECEPTORS PER SA =  1
 NO.=  11   SA=   11   11    AREA = 32.60   SUBPOP A,B,C,D (IN %) =   31.0    7.5    1.0    .0        RECEPTORS PER SA =  1
 NO.=  12   SA=   12   11    AREA = 32.60   SUBPOP A,B,C,D (IN %) =   31.0    6.5    1.0    .0        RECEPTORS PER SA =  1
 NO.=  13   SA=   13   11    AREA = 23.40   SUBPOP A,B,C,D (IN %) =   31.0    8.0    1.0    .0        RECEPTORS PER SA =  1
 NO.=  14   SA=   14   11    AREA = 49.50   SUBPOP A,B,C,D (IN %) =   25.0    9.0    7.0    .0        RECEPTORS PER SA =  1
 NO.=  15   SA=   15   11    AREA = 32.60   SUBPOP A,B,C,D (IN %) =   31.0    8.0    3.5    .0        RECEPTORS PER SA =  1


 NO.=200    SA=  200   39    AREA =125.80   SUBPOP A,B,C,D (IN %) =   27.0    8.0   10.0    .0        RECEPTORS PER SA =  1
 NO.=201    SA=  201   39    AREA =125.80   SUBPOP A,B,C,D (IN %) =   31.0    7.0    5.0    .0        RECEPTORS PER SA =  1
 NO.=202    SA=  202   39    AREA =149.90   SUBPOP A,B,C,D (IN %) =   30.0    9.0   15.0    .0        RECEPTORS PER SA =  1
 NO.=203    SA=  203   39    AREA =149.70   SUBPOP A,B,C,D (IN %) =   27.0    9.5   10.0    .0        RECEPTORS PER SA =  1
 NO.=204    SA=  204   39    AREA = 67.90   SUBPOP A,B,C,D (IN %) =   30.0    8.0    8.0    .0        RECEPTORS PER SA =  1
 NO.=205    SA=  205   39    AREA =109.60   SUBPOP A,B,C,D (IN %) =   24.0   12.5    7.5    .0        RECEPTORS PER SA =  1
 NO.=206    SA=  206   37    AREA =106.10   SUBPOP A,B,C,D (IN %) =   26.0   12.0     .4    .0        RECEPTORS PER SA =  1
 NO.=207    SA=  207   36    AREA =107.80   SUBPOP A,B,C,D (IN %) =   29.0   11.0     .7    .0        RECEPTORS PER SA =  1
 NO.=208    SA=  208   39    AREA = 10.10   SUBPOP A,B,C,D (IN %) =   30.0    6.0    3.5    .0        RECEPTORS PER SA =  1
 NO.=209    SA=  209   25    AREA = 25.60   SUBPOP A,B,C,D (IN %) =   19.2   12.4   14.7    .0        RECEPTORS PER SA =  1
 NO.=210    SA=  210   28    AREA =  6.80   SUBPOP A,B,C,D (IN %) =   27.0   12.0    7.5    .0        RECEPTORS PER SA =  1
 NO.=211    SA=  211   28    AREA = 17.80   SUBPOP A,B,C,D (IN %) =   30.0    8.0   10.0    .0        RECEPTORS PER SA =  1
 NO.=212    SA=  212   29    AREA = 13.70   SUBPOP A,B,C,D (IN %) =   29.0    8.0    4.0    .0        RECEPTORS PER SA =  1
 NO.=213    SA=  213   29    AREA = 20.60   SUBPOP A,B,C,D (IN %) =   29.0    8.0    4.0    .0        RECEPTORS PER SA =  1
 NO.=214    SA=  214   29    AREA = 45.80   SUBPOP A,B,C,D (IN %) =   29.0    8.0    4.0    .0        RECEPTORS PER SA =  1
 NO.=215    SA=  215   29    AREA = 45.80   SUBPOP A,B,C,D (IN %) =   29.0    8.0   10.0    .0        RECEPTORS PER SA =  1
```

```
                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

   NRECEP =  215    NRSA =  215    NMONT =  182    NSITES=  103    NPOPL =  4
     NYEAR =    2     SYEAR =  1971.0     DELTR =  3.0     ADSTD =   75.0

                  POPULATION DATA - TOTAL POPULATION AND ALL WORKERS BY WORK PLACE (  1971.0 )/

NO.=  1  SA=    1    11          TOTAL POP.=    20639.         ALL  WKRS BY WK-PLACE=        0.
NO.=  2  SA=    2    11          TOTAL POP.=   638019.         ALL  WKRS BY WK-PLACE=        0.
NO.=  3  SA=    3    11          TOTAL POP.=    15195.         ALL  WKRS BY WK-PLACE=        0.
NO.=  4  SA=    4    11          TOTAL POP.=    10029.         ALL  WKRS BY WK-PLACE=        0.
NO.=  5  SA=    5    11          TOTAL POP.=    25585.         ALL  WKRS BY WK-PLACE=        0.
NO.=  6  SA=    6    11          TOTAL POP.=     9219.         ALL  WKRS BY WK-PLACE=        0.
NO.=  7  SA=    7    11          TOTAL POP.=    58315.         ALL  WKRS BY WK-PLACE=        0.
NO.=  8  SA=    8    11          TOTAL POP.=    46397.         ALL  WKRS BY WK-PLACE=        0.
NO.=  9  SA=    9    11          TOTAL POP.=   135166.         ALL  WKRS BY WK-PLACE=        0.
NO.= 10  SA=   10    11          TOTAL POP.=    24921.         ALL  WKRS BY WK-PLACE=        0.
NO.= 11  SA=   11    11          TOTAL POP.=    24921.         ALL  WKRS BY WK-PLACE=        0.
NO.= 12  SA=   12    11          TOTAL POP.=     4793.         ALL  WKRS BY WK-PLACE=        0.
NO.= 13  SA=   13    11          TOTAL POP.=     4693.         ALL  WKRS BY WK-PLACE=        0.
NO.= 14  SA=   14    11          TOTAL POP.=    15616.         ALL  WKRS BY WK-PLACE=        0.
NO.= 15  SA=   15    11          TOTAL POP.=     6999.         ALL  WKRS BY WK-PLACE=        0.
[illegible]     16    11          [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     17    11          [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     18    11          [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     19    11          [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     20    11          [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     21                [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     22                [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     23                [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     24                [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     25                [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]     26                [illegible]                   [illegible] BY WK-PLACE=        0.
[illegible]
NO.=199  SA=  199    39          TOTAL POP.=    45834.         ALL  WKRS BY WK-PLACE=        0.
NO.=200  SA=  200    39          TOTAL POP.=    18667.         ALL  WKRS BY WK-PLACE=        0.
NO.=201  SA=  201    39          TOTAL POP.=    17560.         ALL  WKRS BY WK-PLACE=        0.
NO.=202  SA=  202    39          TOTAL POP.=    14426.         ALL  WKRS BY WK-PLACE=        0.
NO.=203  SA=  203    39          TOTAL POP.=     4146.         ALL  WKRS BY WK-PLACE=        0.
NO.=204  SA=  204    39          TOTAL POP.=     4482.         ALL  WKRS BY WK-PLACE=        0.
NO.=205  SA=  205    39          TOTAL POP.=    21877.         ALL  WKRS BY WK-PLACE=        0.
NO.=206  SA=  206    37          TOTAL POP.=    22001.         ALL  WKRS BY WK-PLACE=        0.
NO.=207  SA=  207    36          TOTAL POP.=     7955.         ALL  WKRS BY WK-PLACE=        0.
NO.=208  SA=  208    39          TOTAL POP.=     1599.         ALL  WKRS BY WK-PLACE=        0.
NO.=209  SA=  209    25          TOTAL POP.=   181590.         ALL  WKRS BY WK-PLACE=        0.
NO.=210  SA=  210    28          TOTAL POP.=    39096.         ALL  WKRS BY WK-PLACE=        0.
NO.=211  SA=  211    28          TOTAL POP.=    29791.         ALL  WKRS BY WK-PLACE=        0.
NO.=212  SA=  212    29          TOTAL POP.=    14489.         ALL  WKRS BY WK-PLACE=        0.
NO.=213  SA=  213    29          TOTAL POP.=     9600.         ALL  WKRS BY WK-PLACE=        0.
NO.=214  SA=  214    29          TOTAL POP.=    21333.         ALL  WKRS BY WK-PLACE=        0.
NO.=215  SA=  215    29          TOTAL POP.=    21333.         ALL  WKRS BY WK-PLACE=        0.
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                        LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

    NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  4
    NYEAR =    2     SYEAR =  1971.0     DELTR =  3.0     AQSTD =   75.0

                        AIR MONITORING STATIONS

NO.=    1      STATION NO.=    1   11          X-Y COORDINATE =    124.00    116.50
NO.=    2      STATION NO.=    2   11          X-Y COORDINATE =    124.00    116.50
NO.=    3      STATION NO.=    3   11          X-Y COORDINATE =    123.50    114.50
NO.=    4      STATION NO.=    4   11          X-Y COORDINATE =    106.00    135.50
NO.=    5      STATION NO.=    5   11          X-Y COORDINATE =    118.50    116.50
NO.=    6      STATION NO.=    6   11          X-Y COORDINATE =     92.00    100.50
NO.=    7      STATION NO.=    7   11          X-Y COORDINATE =     94.50    103.50
NO.=    8      STATION NO.=    8   11          X-Y COORDINATE =     91.00     99.00
NO.=    9      STATION NO.=    9   11          X-Y COORDINATE =     87.50    107.00
NO.=   10      STATION NO.=   10   11          X-Y COORDINATE =     91.50    105.50
NO.=   11      STATION NO.=   11   11          X-Y COORDINATE =     94.50    102.50
NO.=   12      STATION NO.=   12   11          X-Y COORDINATE =    108.50    111.00
NO.=   13      STATION NO.=   13   11          X-Y COORDINATE =    109.00    112.00
NO.=   14      STATION NO.=   14   11          X-Y COORDINATE =     99.50    104.50

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NO.=  162      STATION NO.=  162   26          X-Y COORDINATE =     72.50     62.50
NO.=  163      STATION NO.=  163   25          X-Y COORDINATE =     77.00     57.50
NO.=  164      STATION NO.=  164   26          X-Y COORDINATE =     66.00     62.00
NO.=  165      STATION NO.=  165   11          X-Y COORDINATE =    124.00    115.00
NO.=  166      STATION NO.=  166   11          X-Y COORDINATE =    106.00    135.50
NO.=  167      STATION NO.=  167   11          X-Y COORDINATE =     95.00    102.00
NO.=  168      STATION NO.=  168   11          X-Y COORDINATE =     99.50    105.50
NO.=  169      STATION NO.=  169   11          X-Y COORDINATE =     98.50    106.50
NO.=  170      STATION NO.=  170   33          X-Y COORDINATE =     61.00     90.00
NO.=  171      STATION NO.=  171   32          X-Y COORDINATE =     55.00     68.00
NO.=  172      STATION NO.=  172   32          X-Y COORDINATE =     55.00     68.00
NO.=  173      STATION NO.=  173   33          X-Y COORDINATE =     61.00     90.00
NO.=  174      STATION NO.=  174   32          X-Y COORDINATE =     61.00     77.00
NO.=  175      STATION NO.=  175   38          X-Y COORDINATE =     32.00     57.00
NO.=  176      STATION NO.=  176   38          X-Y COORDINATE =     45.00     57.00
NO.=  177      STATION NO.=  177   38          X-Y COORDINATE =     47.00     55.00
NO.=  178      STATION NO.=  178   33          X-Y COORDINATE =     52.00     72.00
NO.=  179      STATION NO.=  179   28          X-Y COORDINATE =     52.00     72.50
NO.=  180      STATION NO.=  180   37          X-Y COORDINATE =     15.00     42.00
NO.=  181      STATION NO.=  181   29          X-Y COORDINATE =     47.50     72.50
NO.=  182      STATION NO.=  182   11          X-Y COORDINATE =    124.00    115.00
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                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA


    NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  4
    NYEAR =    2     SYEAR =  1971.0      DELYR =  3.0      ADSTD =   75.0

                       RECEPTOR SPECIFICATION DATA


 NO.=    1   RECEPT NO. =     1    11     X-Y COORD = 105.00 145.00     TPOPL - WKRPL =  20639.        0.       AREA =  192.70
 NO.=    2   RECEPT NO. =     2    11     X-Y COORD = 105.00 135.00     TPOPL - WKRPL = 638014.        0.       AREA =  143.20
 NO.=    3   RECEPT NO. =     3    11     X-Y COORD = 115.00 135.00     TPOPL - WKRPL =  15195.        0.       AREA =  130.20
 NO.=    4   RECEPT NO. =     4    11     X-Y COORD = 125.00 135.00     TPOPL - WKRPL =  10029.        0.       AREA =   85.90
 NO.=    5   RECEPT NO. =     5    11     X-Y COORD = 105.00 125.00     TPOPL - WKRPL =  25985.        0.       AREA =  127.60
 NO.=    6   RECEPT NO. =     6    11     X-Y COORD = 115.00 125.00     TPOPL - WKRPL =   9219.        0.       AREA =  130.20
 NO.=    7   RECEPT NO. =     7    11     X-Y COORD = 125.00 125.00     TPOPL - WKRPL =  58315.        0.       AREA =  158.90
 NO.=    8   RECEPT NO. =     8    11     X-Y COORD = 127.50 117.50     TPOPL - WKRPL =  46387.        0.       AREA =   46.90
 NO.=    9   RECEPT NO. =     9    11     X-Y COORD = 122.50 117.50     TPOPL - WKRPL = 135166.        0.       AREA =   32.60
 NO.=   10   RECEPT NO. =    10    11     X-Y COORD = 117.50 117.50     TPOPL - WKRPL =  24421.        0.       AREA =   32.60
 NO.=   11   RECEPT NO. =    11    11     X-Y COORD = 112.50 117.50     TPOPL - WKRPL =  24421.        0.       AREA =   32.60
 NO.=   12   RECEPT NO. =    12    11     X-Y COORD = 107.50 117.50     TPOPL - WKRPL =   9793.        0.       AREA =   32.60
 NO.=   13   RECEPT NO. =    13    11     X-Y COORD = 102.50 117.50     TPOPL - WKRPL =   9693.        0.       AREA =   23.40
 NO.=   14   RECEPT NO. =    14    11     X-Y COORD =  97.50 112.50     TPOPL - WKRPL =  15616.        0.       AREA =   49.50
 NO.=   15   RECEPT NO. =    15    11     X-Y COORD = 102.50 112.50     TPOPL - WKRPL =   6449.        0.       AREA =   32.60

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 NO.=  200   RECEPT NO. =   200    39     X-Y COORD =  55.00  25.00     TPOPL - WKRPL =  18667.        0.       AREA =  125.80
 NO.=  201   RECEPT NO. =   201    39     X-Y COORD =  45.00  25.00     TPOPL - WKRPL =  17560.        0.       AREA =  175.80
 NO.=  202   RECEPT NO. =   202    39     X-Y COORD =  35.00  24.00     TPOPL - WKRPL =  14426.        0.       AREA =  140.90
 NO.=  203   RECEPT NO. =   203    39     X-Y COORD =  25.00  18.00     TPOPL - WKRPL =   4146.        0.       AREA =  149.70
 NO.=  204   RECEPT NO. =   204    39     X-Y COORD =  47.00  18.00     TPOPL - WKRPL =   9482.        0.       AREA =   67.90
 NO.=  205   RECEPT NO. =   205    39     X-Y COORD =  55.00  17.00     TPOPL - WKRPL =  21477.        0.       AREA =  100.60
 NO.=  206   RECEPT NO. =   206    37     X-Y COORD =  18.50  71.50     TPOPL - WKRPL =  22001.        0.       AREA =  106.10
 NO.=  207   RECEPT NO. =   207    36     X-Y COORD =   7.50  87.00     TPOPL - WKRPL =   7955.        0.       AREA =  107.80
 NO.=  208   RECEPT NO. =   208    39     X-Y COORD =  64.00  46.00     TPOPL - WKRPL =   1549.        0.       AREA =   10.10
 NO.=  209   RECEPT NO. =   209    25     X-Y COORD =  75.00  56.50     TPOPL - WKRPL = 181590.        0.       AREA =   25.60
 NO.=  210   RECEPT NO. =   210    28     X-Y COORD =  88.00  57.50     TPOPL - WKRPL =  39096.        0.       AREA =    6.80
 NO.=  211   RECEPT NO. =   211    28     X-Y COORD = 105.00  59.50     TPOPL - WKRPL =  24791.        0.       AREA =   17.80
 NO.=  212   RECEPT NO. =   212    29     X-Y COORD = 120.00  61.50     TPOPL - WKRPL =  14484.        0.       AREA =   13.70
 NO.=  213   RECEPT NO. =   213    29     X-Y COORD = 132.00  64.50     TPOPL - WKRPL =   9600.        0.       AREA =   20.60
 NO.=  214   RECEPT NO. =   214    29     X-Y COORD = 135.00  92.00     TPOPL - WKRPL =  21333.        0.       AREA =   45.80
 NO.=  215   RECEPT NO. =   215    29     X-Y COORD = 145.00  92.00     TPOPL - WKRPL =  21333.        0.       AREA =   45.80
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LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

                                  AIR QUALITY MONITORING DATA

                          YEAR :
                           1971.     1974.
  2   ST.ID.NO. =    2   11     58.0      45.0
  5   ST.ID.NO. =    5   11     68.0      38.0
  6   ST.ID.NO. =    6   11     55.0      44.0
  7   ST.ID.NO. =    7   11     61.0      51.0
  8   ST.ID.NO. =    8   11     58.0      53.0
 10   ST.ID.NO. =   10   11     46.0      44.0
 11   ST.ID.NO. =   11   11     75.0      65.0
 12   ST.ID.NO. =   12   11     60.0      53.0
 13   ST.ID.NO. =   13   11     73.0      48.0
 15   ST.ID.NO. =   15   11    125.0      36.0
 16   ST.ID.NO. =   16   11     46.0      46.0
 18   ST.ID.NO. =   18   11     58.0      36.0
 20   ST.ID.NO. =   20   32     90.0      65.0

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151   ST.ID.NO. =  151   27     80.0      63.0
152   ST.ID.NO. =  152   27     90.0      74.0
153   ST.ID.NO. =  153   27     71.0      61.0
154   ST.ID.NO. =  154   24     92.0      60.0
155   ST.ID.NO. =  155   23     95.0      65.0
156   ST.ID.NO. =  156   23     88.0      62.0
157   ST.ID.NO. =  157   25    123.0      44.0
158   ST.ID.NO. =  158   25    105.0      74.0
159   ST.ID.NO. =  159   25    112.0      72.0
160   ST.ID.NO. =  160   25     77.0      54.0
161   ST.ID.NO. =  161   26     70.0      57.0
162   ST.ID.NO. =  162   26     83.0      64.0

   STATION AVERAGE =            79.20     61.15
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                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

    NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  9
    NYEAR =    2     SYEAR =  1971.0     DELYR =  3.0     AQSTD =   75.0

                 INTERPOLATED - EXTERPOLATED  CONCENRATIONS AT RECEPTOR SITES     YEAR = 1971.0
    NO. OF VALID MONITORING STATIONS= 103

   RECEPT NO. =     1   11        67.2
   RECEPT NO. =     2   11        67.2
   RECEPT NO. =     3   11        61.8
   RECEPT NO. =     4   11        60.8
   RECEPT NO. =     5   11        67.2
   RECEPT NO. =     6   11        66.2
   RECEPT NO. =     7   11        60.1
   RECEPT NO. =     8   11        58.4
   RECEPT NO. =     9   11        59.5
   RECEPT NO. =    10   11        67.7
   RECEPT NO. =    11   11        67.7
   RECEPT NO. =    12   11        67.5
   RECEPT NO. =    13   11        60.2
   RECEPT NO. =    14   11        69.9
   RECEPT NO. =    15   11        56.4

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   RECEPT NO. =  200   39        74.4
   RECEPT NO. =  201   39        65.6
   RECEPT NO. =  202   39        55.3
   RECEPT NO. =  203   39        52.7
   RECEPT NO. =  204   39        67.1
   RECEPT NO. =  205   39        74.3
   RECEPT NO. =  206   37        65.2
   RECEPT NO. =  207   36        59.7
   RECEPT NO. =  208   39        82.9
   RECEPT NO. =  209   25        79.9
   RECEPT NO. =  210   28        89.2
   RECEPT NO. =  211   28        82.1
   RECEPT NO. =  212   29        64.8
   RECEPT NO. =  213   29        59.1
   RECEPT NO. =  214   29        71.6
   RECEPT NO. =  215   29        60.7
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                  LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  9
NYEAR =    2     SYEAR =  1971.0     DELYR =  3.0     AQSTD =   75.0

              EXPOSURE DISTRIBUTIONS FOR   YEAR =  1971.0   POPL CL = 1   TPOPL = 17982208.     TAREA =     11828.

                 POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS

                          DISTRIBUTION FUNCTIONS                      FREQUENCY FUNCTIONS
     AIR QUALITY VALUE        AREA          POPULATION                  AREA          POPULATION
          115.0              .0121            .0836                    .0121            .0836

          110.0              .0192            .1138                    .0071            .0302

          105.0              .0249            .1590                    .0057            .0451

          100.0              .0363            .1951                    .0114            .0361

           95.0              .0527            .2620                    .0164            .0669

           90.0              .0762            .3445                    .0235            .0825

           85.0              .1016            .4156                    .0254            .0711

           80.0              .1725            .4659                    .0209            .0503

           75.0              .1856            .5786                    .0631            .1127

           70.0              .3245            .6744                    .1389            .0958

           65.0              .5034            .7945                    .1789            .1201

           60.0              .6056            .8619                    .1022            .0673

           55.0              .8225            .9353                    .2169            .0735

           50.0              .9368            .9785                    .1143            .0431

           45.0              .9886            .9989                    .0519            .0205

           40.0             1.0000           1.0000                    .0114            .0011

           35.0             1.0000           1.0000                    .0000            .0000

           30.0             1.0000           1.0000                    .0000            .0000

        SPATIAL AVERAGE CONCENTRATION =    66.7623
        POPULATION AVERAGE CONCENTRATION=   83.0952
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                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  4
NYEAR =    2     SYEAR =  1971.0     DELYR =  3.0      AQSTD =   75.0

              EXPOSURE DISTRIBUTIONS FOR   YEAR =  1971.0   POPL CL = 2   TPOPL =  9278015.     TAREA =    11828.

                  POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS

                          DISTRIBUTION FUNCTIONS                             FREQUENCY FUNCTIONS
   AIR QUALITY VALUE         AREA          POPULATION                   AREA          POPULATION
         115.0               .0121           .0775                      .0121           .0775

         110.0               .0192           .1009                      .0071           .0234

         105.0               .0249           .1314                      .0057           .0305

         100.0               .0363           .1644                      .0114           .0330

          95.0               .0527           .2232                      .0164           .0588

          90.0               .0762           .3029                      .0235           .0797

          85.0               .1016           .3710                      .0254           .0681

          80.0               .1225           .4205                      .0209           .0495

          75.0               .1856           .5277                      .0631           .1071

          70.0               .3245           .6323                      .1389           .1046

          65.0               .5034           .7633                      .1789           .1310

          60.0               .6056           .8384                      .1022           .0751

          55.0               .8225           .9210                      .2169           .0825

          50.0               .9368           .9734                      .1143           .0524

          45.0               .9886           .9987                      .0519           .0253

          40.0              1.0000          1.0000                      .0114           .0013

          35.0              1.0000          1.0000                      .0000           .0000

          30.0              1.0000          1.0000                      .0000           .0000

              SPATIAL AVERAGE CONCENTRATION =   66.7623
              POPULATION AVERAGE CONCENTRATION=   80.9489
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                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

 NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  4
 NYEAR =    2     SYEAR =  1971.0     DELYR =  3.0     AQSTD =   75.0

              EXPOSURE DISTRIBUTIONS FOR   YEAR =  1971.0   POPL CL = 3   TPOPL =  1893995.     TAREA =    11828.

                  POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS

          AIR QUALITY VALUE    DISTRIBUTION FUNCTIONS                FREQUENCY FUNCTIONS
                                  AREA        POPULATION                AREA        POPULATION
               115.0             .0121          .0937                  .0121          .0937
               110.0             .0192          .1317                  .0071          .0379
               105.0             .0249          .1920                  .0057          .0604
               100.0             .0363          .2321                  .0114          .0401
                95.0             .0527          .3081                  .0164          .0760
                90.0             .0762          .3953                  .0235          .0872
                85.0             .1016          .4704                  .0254          .0751
                80.0             .1725          .5220                  .0209          .0516
                75.0             .1856          .6434                  .0631          .1214
                70.0             .3245          .7301                  .1389          .0867
                65.0             .5034          .8309                  .1789          .1008
                60.0             .6056          .8907                  .1022          .0598
                55.0             .8225          .9537                  .2169          .0630
                50.0             .9368          .9839                  .1143          .0302
                45.0             .9886          .9994                  .0519          .0155
                40.0            1.0000         1.0000                  .0114          .0006
                35.0            1.0000         1.0000                  .0000          .0000
                30.0            1.0000         1.0000                  .0000          .0000

              SPATIAL AVERAGE CONCENTRATION =   66.7623
              POPULATION AVERAGE CONCENTRATION=   85.7902
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                LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  4
NYEAR =     2    SYEAR =  1971.0     DELYR =  3.0      ADSTD =   75.0

            EXPOSURE DISTRIBUTIONS FOR   YEAR =  1971.0   POPL CL = 4   TPOPL =  2684941.     TAREA =    11828.

               POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS

                            DISTRIBUTION FUNCTIONS                        FREQUENCY FUNCTIONS
      AIR QUALITY VALUE      AREA          POPULATION                   AREA          POPULATION
          115.0             .0121            .1317                      .0121           .1317

          110.0             .0192            .1769                      .0071           .0952

          105.0             .0249            .2577                      .0057           .0808

          100.0             .0363            .2882                      .0114           .0305

           95.0             .0527            .3778                      .0164           .0896

           90.0             .0762            .4858                      .0235           .1080

           85.0             .1016            .5668                      .0254           .0810

           80.0             .1725            .6222                      .0209           .0554

           75.0             .1956            .7557                      .0631           .1335

           70.0             .3245            .8036                      .1389           .0479

           65.0             .5034            .9111                      .1789           .1076

           60.0             .6056            .9562                      .1022           .0450

           55.0             .8225            .9798                      .2169           .0237

           50.0             .9368            .9950                      .1143           .0152

           45.0             .9886            .9998                      .0519           .0047

           40.0            1.0000           1.0000                      .0114           .0002

           35.0            1.0000           1.0000                      .0000           .0000

           30.0            1.0000           1.0000                      .0000           .0000

            SPATIAL AVERAGE CONCENTRATION =   66.7623
            POPULATION AVERAGE CONCENTRATION=   91.2631
```

```
                      LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA
   NRECEP =  215   NRSA =  215   NMONT =  187   NSITES=  103   NPOPL =  4
   NYEAR =     2      SYEAR =  1971.0     DELYR =  3.0     AQSTD =   75.0
                INTERPOLATED - EXTERPOLATED  CONCENRATIONS AT RECEPTOR SITES     YEAR = 1974.0
   NO. OF VALID MONITORING STATIONS= 103
  RECEPT NO. =     1   11        45.9
  RECEPT NO. =     2   11        46.1
  RECEPT NO. =     3   11        39.6
  RECEPT NO. =     4   11        39.4
  RECEPT NO. =     5   11        46.9
  RECEPT NO. =     6   11        42.1
  RECEPT NO. =     7   11        39.4
  RECEPT NO. =     8   11        38.3
  RECEPT NO. =     9   11        43.4
  RECEPT NO. =    10   11        38.5
  RECEPT NO. =    11   11        45.3
  RECEPT NO. =    12   11        48.5
  RECEPT NO. =    13   11        49.0
  RECEPT NO. =    14   11        43.4
  RECEPT NO. =    15   11        48.4
  RECEPT NO. =    16   11        50.1

          .

          .

          .

  RECEPT NO. =   200   39        53.4
  RECEPT NO. =   201   39        54.4
  RECEPT NO. =   202   39        58.7
  RECEPT NO. =   203   39        56.9
  RECEPT NO. =   204   39        53.6
  RECEPT NO. =   205   39        54.1
  RECEPT NO. =   206   37        50.9
  RECEPT NO. =   207   36        46.2
  RECEPT NO. =   208   39        70.5
  RECEPT NO. =   209   25        67.3
  RECEPT NO. =   210   28        64.1
  RECEPT NO. =   211   28        53.4
  RECEPT NO. =   212   29        50.7
  RECEPT NO. =   213   29        42.2
  RECEPT NO. =   214   29        44.9
  RECEPT NO. =   215   29        39.2
```

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                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

   NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  4
   NYEAR =    2     SYEAR =  1971.0     DELYR =  3.0     AQSTD =   75.0

             EXPOSURE DISTRIBUTIONS FOR   YEAR =  1974.0   POPL CL. = 1   TPOPL = 17982208.     TAREA =    11828.

                    POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS

      AIR QUALITY VALUE      DISTRIBUTION FUNCTIONS                        FREQUENCY FUNCTIONS
                               AREA           POPULATION                    AREA         POPULATION
           115.0              .0000            .0000                       .0000          .0000

           110.0              .0000            .0000                       .0000          .0000

           105.0              .0000            .0000                       .0000          .0000

           100.0              .0000            .0000                       .0000          .0000

            95.0              .0000            .0000                       .0000          .0000

            90.0              .0051            .0247                       .0051          .0247

            85.0              .0064            .0309                       .0013          .0062

            80.0              .0151            .1074                       .0086          .0765

            75.0              .0360            .1700                       .0210          .0627

            70.0              .0773            .2802                       .0412          .1102

            65.0              .1190            .3668                       .0417          .0865

            60.0              .2191            .5034                       .1002          .1367

            55.0              .3929            .6912                       .1737          .1877

            50.0              .5861            .8024                       .1932          .1112

            45.0              .8177            .9328                       .2517          .1304

            40.0              .9329            .9807                       .0952          .0479

            35.0             1.0000           1.0000                       .0671          .0193

            30.0             1.0000           1.0000                       .0000          .0000

         SPATIAL AVERAGE CONCENTRATION =    53.7042
         POPULATION AVERAGE CONCENTRATION=    61.7273
```

```
                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  9
NYEAR =    2     SYEAR =  1971.0    DELYR =  3.0    AQSTD =   75.0

                EXPOSURE DISTRIBUTIONS FOR   YEAR =  1974.0  POPL CL = 2   TPOPL =  9274018.    TAREA =    11828.

                   POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS

                        DISTRIBUTION FUNCTIONS                         FREQUENCY FUNCTIONS
      AIR QUALITY VALUE        AREA         POPULATION                  AREA          POPULATION
          115.0               .0000           .0000                     .0000           .0000

          110.0               .0000           .0000                     .0000           .0000

          105.0               .0000           .0000                     .0000           .0000

          100.0               .0000           .0000                     .0000           .0000

           95.0               .0000           .0000                     .0000           .0000

           90.0               .0051           .0168                     .0051           .0168

           85.0               .0064           .0218                     .0013           .0050

           80.0               .0151           .0865                     .0086           .0647

           75.0               .0360           .1412                     .0210           .0547

           70.0               .0773           .2468                     .0412           .1056

           65.0               .1190           .3325                     .0417           .0857

           60.0               .2191           .4634                     .1002           .1309

           55.0               .3929           .6981                     .1737           .1847

           50.0               .5861           .7736                     .1932           .1256

           45.0               .8377           .9215                     .2517           .1979

           40.0               .9329           .9764                     .0952           .0549

           35.0              1.0000          1.0000                     .0671           .0236

           30.0              1.0000          1.0000                     .0000           .0000

             SPATIAL AVERAGE CONCENTRATION =   53.7042
             POPULATION AVERAGE CONCENTRATION=   60.4790
```

```
                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA

  NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  9
  NYEAR =    2     SYEAR =  1971.0    DELYR =  3.0    AQSTD =   75.0

              EXPOSURE DISTRIBUTIONS FOR   YEAR =  1979.0   POPL CL = 3   TPOPL =  1893995.    TAREA =    11828.

                  POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS

                            DISTRIBUTION FUNCTIONS                          FREQUENCY FUNCTIONS
      AIR QUALITY VALUE        AREA         POPULATION                         AREA         POPULATION
            115.0              .0000          .0000                           .0000           .0000

            110.0              .0000          .0000                           .0000           .0000

            105.0              .0000          .0000                           .0000           .0000

            100.0              .0000          .0000                           .0000           .0000

             95.0              .0000          .0000                           .0000           .0000

             90.0              .0051          .0330                           .0051           .0330

             85.0              .0064          .0405                           .0013           .0075

             80.0              .0151          .1327                           .0086           .0922

             75.0              .0360          .2034                           .0210           .0707

             70.0              .0773          .3197                           .0412           .1163

             65.0              .1190          .4052                           .0417           .0855

             60.0              .2191          .5491                           .1002           .1438

             55.0              .3929          .7384                           .1737           .1893

             50.0              .5861          .8332                           .1932           .0949

             45.0              .8377          .9431                           .2517           .1099

             40.0              .9329          .9842                           .0952           .0410

             35.0             1.0000         1.0000                           .0671           .0158

             30.0             1.0000         1.0000                           .0000           .0000

          SPATIAL AVERAGE CONCENTRATION =   53.7097
          POPULATION AVERAGE CONCENTRATION=   63.1977
```

```
                    LONG-TERM POPULATION EXPOSURE MODEL - N.Y., N.J., CONN. AREA


NRECEP =  215   NRSA =  215   NMONT =  182   NSITES=  103   NPOPL =  9
NYEAR =    2     SYEAR =  1971.0     DELTS =  3.0     ADSTD =   75.0
                EXPOSURE DISTRIBUTIONS FOR   YEAR =  1979.0   POPL CL = 9   TPOPL =  2684991.     TAREA =     11828.

                  POPULATION AND LAND  AREA EXPOSURE DISTRIBUTIONS
                                 DISTRIBUTION FUNCTIONS                              FREQUENCY FUNCTIONS
          AIR QUALITY VALUE          AREA          POPULATION                     AREA          POPULATION
              115.0                .0000             .0000                      .0000           .0000
              110.0                .0000             .0000                      .0000           .0000
              105.0                .0000             .0000                      .0000           .0000
              100.0                .0000             .0000                      .0000           .0000
               95.0                .0000             .0000                      .0000           .0000
               90.0                .0051             .0429                      .0051           .0429
               85.0                .0064             .0490                      .0013           .0061
               80.0                .0151             .1835                      .0086           .1346
               75.0                .0360             .2470                      .0210           .0635
               70.0                .0773             .3979                      .0412           .1509
               65.0                .1190             .4729                      .0417           .0749
               60.0                .2191             .6674                      .1002           .1945
               55.0                .3929             .8558                      .1737           .1884
               50.0                .5861             .9131                      .1932           .0573
               45.0                .8377             .9816                      .2517           .0686
               40.0                .9329             .9960                      .0952           .0144
               35.0               1.0000            1.0000                      .0671           .0040
               30.0               1.0000            1.0000                      .0000           .0000

            SPATIAL AVERAGE CONCENTRATION =    53.7042
            POPULATION AVERAGE CONCENTRATION=   66.1102
```

3.2 SPEM: Short-Term Population Exposure Model

A. Description

Concentrations at 8 percentiles are estimated at a network of receptor points from the same percentile concentrations at a network of monitoring sites. For each receptor, the program calculates the concentrations from the nearest 3 stations by use of an interpolation formula. A penalty distance can be imposed to account for the influence of barriers such as mountains.

After the percentile concentration distribution is estimated at each receptor point, the fraction of time above a specified threshold concentration is estimated. This is termed risk frequency. Given the risk frequency at each receptor point, exposure statistics are calculated for land area; total population and subpopulations (such as schoolage and elderly).

B. Input Data - General Description

1. Title Card for output tables - Card 1
2. Parameter cards - Card 2,3
3. Percentile concentrations specifies 7 percentiles P2,...P8 for concentration input data. Another percentile, P1 corresponds to the maximum observation and is calculated by the program as 100/(NOBS + 1). Number of observations (NOBS) = 8720 for hourly data and NOBS = 365 for 24 hour data. Percentile values should be selected so that concentration values bracket the threshold value. If possible set P2, P5 and P7 to interesting percentiles such as 1, 10, 50 because of tabulated statistics (See 3.2F). Note that percentiles are defined as percent of observations greater than the specified concentration.
4. Barriers - When barriers are included, the following are required: One card for number of barriers and number of nodes per barrier. One card for each node and penalty distance associated with the node. Up to 20 barriers are allowed. Penalty distance is interpolated between nodes and is added to distance between receptors and monitors for spatial interpolations. If barriers are not used, no cards are needed.

5. Characteristics of Statistical areas - same as input data for LPEM (no.4)

6. Receptor coordinates - same as input data for LPEM (no. 5).

7. No. of receptors per statistical area - same as input data for LPEM (no.6).

8. Site coordinates - same as input data for LPEM (no.7)

9. Population Data - same as input data for LPEM (no. 9).

10. Concentration Data - One card or record for each site. Each record contains a 2 part site ID code and concentrations values for 8 specified percentiles. Only records for sites with data need be included.

11. If additional air quality data are to be analyzed, repeat SPEM items 9 and 10.

C. SPEM Input Data - List of parameters and record format description

Card Column	Variable Type		
		4. Percentile values-defined as percent of observations above specific concentration value parameters	
1-5	F	P TILE (2)-percentile corresponding to highest concentration value (<Max.)	
6-10	F	P TILE (3)	
11-15	F	P TILE (4)	intermediate percentiles in ascending order
16-20	F	P TILE (5) (if possible set equal to 10)	
21-25	F	P TILE (6)	
26-30	F	P TILE (7) (if possible set equal tp 50)	
31-35	F	P TILE (8)- percentile corresponding to lowest concentration	
		10. Concentration data-one card or record for each site with data. parameters	
1-5	I	IN - first part of 2 part ID code	
6-10	I	KN - second part of 2 part ID code	
11-16		(not used)	
17-24	F	CMF(IN,1) - maximum concentration	
25-32	F	CMF(IN,2) - concentration corresponding to PTILE(2)	
33-40	F	CMF(IN,3) - concentration corresponding to PTILE(3)	
41-48	F	CMF(IN,4) - concentration corresponding to PTILE(4)	
49-56	F	CMF(IN,5) - concentration corresponding to PTILE(5)	
57-64	F	CMF(IN,6) - concentration corresponding to PTILE(6)	
65-72	F	CMF(IN,7) - concentration corresponding to PTILE(7)	
73-80	F	CMF(IN,8) - lowest concentration corresponding to PTILE(8)	

D. Sample Run Stream on UNIVAC for SPEM

```
@ ASG,A  TRRP*POPEXP.
@ XQT  TRRP*POPEXP.SPEM          executable version of program
@ ADD  TRRP*POPEXP.SPEM-DATA/L,A sample data
@ ELT,ISL  user file.element  }   saves estimated risk frequency at
@ ADD  8.                     }   receptor sites with x y coordinates
@ EOF                         }   on user file (OPTIONAL)
@ FIN
```

E. Description of Temporary Output Data Files Created by SPEM

1. Estimated Risk Frequency at Receptor Points - output on unit 8

The first record specifies the number of receptor points, r, included in the analysis. The next r records contain information for these r points. Each of these records contain a value for estimated risk frequency, x and y coordinates for the point, receptor number and year. For each additional year of input data, the above pattern is repeated.

Record formats are the same as Monitoring Data from LPEM.

F. Description of SPEM Output

1. The first table describes the input data for characteristics of the statistical areas in terms of land areas, percent of subpopulations and number of receptors per statistical areas.

2. The second table is a printout of the input x y coordinates for all monitoring stations.

3. Then for each year of input data, the following tables are produced.

   a. As a description of the report data, tables are provided for total population per statistical area, receptor specification data, input monitoring percentile data.

   b. A table is provided for interpolated-extrapolated percentile concentrations at the receptor sites.

   c. A table is provided for percent of time (risk) that receptor concentrations exceed multipls of threshold concentration.

4. For each year of input data, tables of exposure distribution are provided for total population and each subpopulation. Population class 1 refers to the total population, and population class i refers to subpopulation i-1.

   a. For three percentile concentrations, cumulative frequency distributions and frequency functions are provided for population and land area exposure. Spatial and population weighted average concentrations are also provided for the three percentiles.

   b. Risk frequency distribution and frequency functions are provided for each total population and each subpopulation. These indicate the fraction of population exposed to levels above multiples of the threshold concentration for various percentages of the time. Spatial and population weighted average frequency of exposure are also provided.

```
                    SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

  NRECEP =   58   NRSA =   55   NMONT =   10   NSITES =   10   NPOPL = 1
  NYEAR =    1    SYEAR = 1973.0    DELYR = 2.0    AQSTD =    8.0

 CENSUS DATA - PER CENT OF TOTAL POPULATION

 NO. =  1  SA =  1  0  AREA =  919.0  SUBPOP A,B,C,D (IN%) = 21.3  10.7   2.4  33.6  RECEPTORS PER SA = 0
 NO. =  2  SA =  2  0  AREA =  325.0  SUBPOP A,B,C,D (IN%) = 25.7  11.2   1.9  39.3  RECEPTORS PER SA = 0
 NO. =  3  SA =  3  0  AREA =  194.0  SUBPOP A,B,C,D (IN%) = 29.4   5.3   8.1  35.7  RECEPTORS PER SA = 0
 NO. =  4  SA =  4  0  AREA =  137.0  SUBPOP A,B,C,D (IN%) = 36.0   2.9   1.3  35.3  RECEPTORS PER SA = 0
 NO. =  5  SA =  5  0  AREA =  150.0  SUBPOP A,B,C,D (IN%) = 32.9   3.9   1.4  38.5  RECEPTORS PER SA = 0
 NO. =  6  SA =  6  0  AREA =  139.0  SUBPOP A,B,C,D (IN%) = 27.3   9.6   2.2  41.2  RECEPTORS PER SA = 0
 NO. =  7  SA =  7  0  AREA =   92.2  SUBPOP A,B,C,D (IN%) = 31.0   3.9   1.4  40.7  RECEPTORS PER SA = 1
 NO. =  8  SA =  8  0  AREA =  379.0  SUBPOP A,B,C,D (IN%) = 29.5   4.7   2.8  37.7  RECEPTORS PER SA = 0
 NO. =  9  SA =  9  0  AREA =  974.0  SUBPOP A,B,C,D (IN%) = 28.6   7.8   4.8  39.3  RECEPTORS PER SA = 0
 NO. = 10  SA = 10  0  AREA =  678.0  SUBPOP A,B,C,D (IN%) = 29.9   7.7   5.2  35.3  RECEPTORS PER SA = 0
 NO. = 11  SA = 11  0  AREA =  527.0  SUBPOP A,B,C,D (IN%) = 18.9   8.7   6.1  34.5  RECEPTORS PER SA = 0
 NO. = 12  SA = 12  0  AREA =  144.0  SUBPOP A,B,C,D (IN%) = 25.8   6.4   1.5  45.0  RECEPTORS PER SA = 3
 NO. = 13  SA = 13  0  AREA =   39.9  SUBPOP A,B,C,D (IN%) = 19.3  10.2   2.0  48.8  RECEPTORS PER SA = 2
 NO. = 14  SA = 14  0  AREA =   76.5  SUBPOP A,B,C,D (IN%) = 31.3   5.3   8.5  39.1  RECEPTORS PER SA = 2
 NO. = 15  SA = 15  0  AREA =   86.9  SUBPOP A,B,C,D (IN%) = 24.9   5.4   1.8  46.1  RECEPTORS PER SA = 1
 NO. = 16  SA = 16  0  AREA =   74.4  SUBPOP A,B,C,D (IN%) = 17.4  11.1   8.6  48.7  RECEPTORS PER SA = 2
 NO. = 17  SA = 17  0  AREA =   97.1  SUBPOP A,B,C,D (IN%) = 17.2  14.5  39.6  48.1  RECEPTORS PER SA = 5
 NO. = 18  SA = 18  0  AREA =   67.9  SUBPOP A,B,C,D (IN%) = 22.7   6.9  14.1  47.4  RECEPTORS PER SA = 3
 NO. = 19  SA = 19  0  AREA =   95.2  SUBPOP A,B,C,D (IN%) = 27.7   5.5   8.7  39.2  RECEPTORS PER SA = 3
 NO. = 20  SA = 20  0  AREA =   60.6  SUBPOP A,B,C,D (IN%) = 19.2  12.5   7.2  41.9  RECEPTORS PER SA = 3
 NO. = 21  SA = 21  0  AREA =  101.0  SUBPOP A,B,C,D (IN%) = 27.3   8.4  36.4  35.8  RECEPTORS PER SA = 5
 NO. = 22  SA = 22  0  AREA =  120.0  SUBPOP A,B,C,D (IN%) = 28.1   5.7   2.0  41.5  RECEPTORS PER SA = 3
 NO. = 23  SA = 23  0  AREA =    6.2  SUBPOP A,B,C,D (IN%) = 10.9  16.4  16.8  44.0  RECEPTORS PER SA = 1
 NO. = 24  SA = 24  0  AREA =   71.4  SUBPOP A,B,C,D (IN%) = 20.2  13.0   6.8  45.0  RECEPTORS PER SA = 3
 NO. = 25  SA = 25  0  AREA =  146.0  SUBPOP A,B,C,D (IN%) = 22.5  12.0   9.2  43.1  RECEPTORS PER SA = 4
 NO. = 26  SA = 26  0  AREA =  170.0  SUBPOP A,B,C,D (IN%) = 33.2   4.3   3.6  38.4  RECEPTORS PER SA = 3
 NO. = 27  SA = 27  0  AREA =   60.0  SUBPOP A,B,C,D (IN%) = 27.4   9.6   9.8  38.9  RECEPTORS PER SA = 1
 NO. = 28  SA = 28  0  AREA =  236.0  SUBPOP A,B,C,D (IN%) = 29.0   7.2   3.6  37.6  RECEPTORS PER SA = 2
 NO. = 29  SA = 29  0  AREA =  231.0  SUBPOP A,B,C,D (IN%) = 26.6  11.2   8.1  34.8  RECEPTORS PER SA = 2
 NO. = 30  SA = 30  0  AREA =  806.0  SUBPOP A,B,C,D (IN%) = 26.0  10.1   1.0  38.6  RECEPTORS PER SA = 0
 NO. = 31  SA = 31  0  AREA = 9484.0  SUBPOP A,B,C,D (IN%) = 21.4   3.0   9.8  20.9  RECEPTORS PER SA = 0
 NO. = 32  SA = 32  0  AREA = 3034.0  SUBPOP A,B,C,D (IN%) = 28.4   7.4   7.9  31.0  RECEPTORS PER SA = 0
 NO. = 33  SA = 33  0  AREA = 3452.0  SUBPOP A,B,C,D (IN%) = 17.4  20.2   4.2  21.1  RECEPTORS PER SA = 0
 NO. = 34  SA = 34  0  AREA = 2880.0  SUBPOP A,B,C,D (IN%) = 25.9  11.4   8.1  39.4  RECEPTORS PER SA = 0
 NO. = 35  SA = 35  0  AREA =   28.8  SUBPOP A,B,C,D (IN%) = 33.1   3.4   2.5  38.9  RECEPTORS PER SA = 1
 NO. = 36  SA = 36  0  AREA =   45.6  SUBPOP A,B,C,D (IN%) = 28.4   5.8   2.4  42.7  RECEPTORS PER SA = 1
 NO. = 37  SA = 37  0  AREA =   49.8  SUBPOP A,B,C,D (IN%) = 28.4   5.7   2.3  42.7  RECEPTORS PER SA = 2
 NO. = 38  SA = 38  0  AREA =   62.4  SUBPOP A,B,C,D (IN%) = 29.2   7.1   2.4  38.4  RECEPTORS PER SA = 2
 NO. = 39  SA = 39  0  AREA =  100.0  SUBPOP A,B,C,D (IN%) = 21.7  13.2   1.7  42.5  RECEPTORS PER SA = 0
 NO. = 40  SA = 40  0  AREA =   71.1  SUBPOP A,B,C,D (IN%) = 22.7  14.0   2.4  36.2  RECEPTORS PER SA = 0
 NO. = 41  SA = 41  0  AREA =  101.0  SUBPOP A,B,C,D (IN%) = 33.6   3.2   1.8  37.1  RECEPTORS PER SA = 1
 NO. = 42  SA = 42  0  AREA =   52.2  SUBPOP A,B,C,D (IN%) = 27.2   6.9   4.4  41.4  RECEPTORS PER SA = 2
 NO. = 43  SA = 43  0  AREA =  205.0  SUBPOP A,B,C,D (IN%) = 31.4   2.4   1.5  36.5  RECEPTORS PER SA = 0
 NO. = 44  SA = 44  0  AREA =   90.4  SUBPOP A,B,C,D (IN%) = 20.1  10.0   6.4  19.3  RECEPTORS PER SA = 0
 NO. = 45  SA = 45  0  AREA =   61.1  SUBPOP A,B,C,D (IN%) = 28.3   9.0   8.9  34.6  RECEPTORS PER SA = 0
 NO. = 46  SA = 46  0  AREA =  354.0  SUBPOP A,B,C,D (IN%) = 28.0   7.5   6.4  36.3  RECEPTORS PER SA = 0
 NO. = 47  SA = 47  0  AREA =  289.0  SUBPOP A,B,C,D (IN%) = 20.2  30.0  11.1  22.4  RECEPTORS PER SA = 0
```

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NO. = 48   SA =   48   0   AREA =  129.0   SUBPOP A,B,C,D (IN%) =   17.5   32.1   2.2   28.3      RECEPTORS PER SA =   0
NO. = 49   SA =   49   0   AREA =  504.0   SUBPOP A,B,C,D (IN%) =   22.2   24.0   8.1   30.0      RECEPTORS PER SA =   0
NO. = 50   SA =   50   0   AREA =  238.0   SUBPOP A,B,C,D (IN%) =   23.5   22.2   9.3   31.1      RECEPTORS PER SA =   0
NO. = 51   SA =   51   0   AREA =  709.0   SUBPOP A,B,C,D (IN%) =   21.1   17.4   2.4   34.6      RECEPTORS PER SA =   0
NO. = 52   SA =   52   0   AREA =  478.0   SUBPOP A,B,C,D (IN%) =   17.3   22.1   5.1   39.1      RECEPTORS PER SA =   0
NO. = 53   SA =   53   0   AREA =  347.0   SUBPOP A,B,C,D (IN%) =   31.2    5.5   8.6   39.9      RECEPTORS PER SA =   0
NO. = 54   SA =   54   0   AREA = 4070.0   SUBPOP A,B,C,D (IN%) =   29.8    6.9   9.6   36.8      RECEPTORS PER SA =   0
NO. = 55   SA =   55   0   AREA = 4241.0   SUBPOP A,B,C,D (IN%) =   32.1    7.5   6.1   33.9      RECEPTORS PER SA =   0
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                      SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

     NRECEP =    58   NRSA =    55   NMONT =    10   NSITES =    10   NPOPL = 1
     NYEAR =     1    SYEAR =  1973.0      DELYR =  2.0      AQSTD =     8.0

                              AIR MONITORING STATIONS

   NO.=   1     STATION NO.=   1    0          X-Y COORDINATE =    1824.     1340.
   NO.=   2     STATION NO.=   2    0          X-Y COORDINATE =    1819.     1634.
   NO.=   3     STATION NO.=   3    0          X-Y COORDINATE =    1520.     1681.
   NO.=   4     STATION NO.=   4    0          X-Y COORDINATE =    1470.     1446.
   NO.=   5     STATION NO.=   5    0          X-Y COORDINATE =    1610.     1346.
   NO.=   6     STATION NO.=   6    0          X-Y COORDINATE =    1570.     1552.
   NO.=   7     STATION NO.=   7    0          X-Y COORDINATE =    1900.     1554.
   NO.=   8     STATION NO.=   8    0          X-Y COORDINATE =    1347.     1699.
   NO.=   9     STATION NO.=   9    0          X-Y COORDINATE =    2315.     1602.
   NO.=  10     STATION NO.=  10    0          X-Y COORDINATE =    1426.     1550.
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                    SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

   NREP =     58   NRSA =     55   NMONT =     10   NSITES =     10   NPOPL = 1
   NYEAR =     1   SYEAR = 1973.0    DELYR = 2.0      AQSTD =     8.0
             POPULATION DATA - TOTAL POPULATION AND ALL WORKERS BY WORK PLACE ( 1973.0 )/
NO. =  1    SA =   1.0    TOTAL POP.=     355.    ALL WKRS BY WK-PLACE=     98.
NO. =  2    SA =   2.0    TOTAL POP.=  114747.    ALL WKRS BY WK-PLACE=  40183.
NO. =  3    SA =   3.0    TOTAL POP.=  149709.    ALL WKRS BY WK-PLACE=  61380.
NO. =  4    SA =   4.0    TOTAL POP.=   74430.    ALL WKRS BY WK-PLACE=   3499.
NO. =  5    SA =   5.0    TOTAL POP.=   66284.    ALL WKRS BY WK-PLACE=  15668.
NO. =  6    SA =   6.0    TOTAL POP.=   10778.    ALL WKRS BY WK-PLACE=   3389.
NO. =  7    SA =   7.0    TOTAL POP.=   25229.    ALL WKRS BY WK-PLACE=   9781.
NO. =  8    SA =   8.0    TOTAL POP.=   55448.    ALL WKRS BY WK-PLACE=   7522.
NO. =  9    SA =   9.0    TOTAL POP.=   54467.    ALL WKRS BY WK-PLACE=  15441.
NO. = 10    SA =  10.0    TOTAL POP.=   32907.    ALL WKRS BY WK-PLACE=  14977.
NO. = 11    SA =  11.0    TOTAL POP.=    1868.    ALL WKRS BY WK-PLACE=   1108.
NO. = 12    SA =  12.0    TOTAL POP.=  555784.    ALL WKRS BY WK-PLACE= 204112.
NO. = 13    SA =  13.0    TOTAL POP.=  259230.    ALL WKRS BY WK-PLACE= 137308.
NO. = 14    SA =  14.0    TOTAL POP.=  268969.    ALL WKRS BY WK-PLACE=  58558.
NO. = 15    SA =  15.0    TOTAL POP.=   14347.    ALL WKRS BY WK-PLACE=   2951.
NO. = 16    SA =  16.0    TOTAL POP.=  310499.    ALL WKRS BY WK-PLACE= 138268.
NO. = 17    SA =  17.0    TOTAL POP.=  916097.    ALL WKRS BY WK-PLACE= 441189.
NO. = 18    SA =  18.0    TOTAL POP.=  520256.    ALL WKRS BY WK-PLACE= 257245.
NO. = 19    SA =  19.0    TOTAL POP.=  424463.    ALL WKRS BY WK-PLACE= 152043.
NO. = 20    SA =  20.0    TOTAL POP.=  421396.    ALL WKRS BY WK-PLACE= 194816.
NO. = 21    SA =  21.0    TOTAL POP.=  790942.    ALL WKRS BY WK-PLACE= 480927.
NO. = 22    SA =  22.0    TOTAL POP.=  608702.    ALL WKRS BY WK-PLACE= 153721.
NO. = 23    SA =  23.0    TOTAL POP.=   85296.    ALL WKRS BY WK-PLACE= 327291.
NO. = 24    SA =  24.0    TOTAL POP.=  407124.    ALL WKRS BY WK-PLACE= 141102.
NO. = 25    SA =  25.0    TOTAL POP.=  659353.    ALL WKRS BY WK-PLACE= 247002.
NO. = 26    SA =  26.0    TOTAL POP.=  461752.    ALL WKRS BY WK-PLACE= 122408.
NO. = 27    SA =  27.0    TOTAL POP.=  190059.    ALL WKRS BY WK-PLACE=  66336.
NO. = 28    SA =  28.0    TOTAL POP.=  245937.    ALL WKRS BY WK-PLACE=  76219.
NO. = 29    SA =  29.0    TOTAL POP.=  302942.    ALL WKRS BY WK-PLACE=  36378.
NO. = 30    SA =  30.0    TOTAL POP.=   22697.    ALL WKRS BY WK-PLACE=   6211.
NO. = 31    SA =  31.0    TOTAL POP.=    7597.    ALL WKRS BY WK-PLACE=   4121.
NO. = 32    SA =  32.0    TOTAL POP.=   80062.    ALL WKRS BY WK-PLACE=  29191.
NO. = 33    SA =  33.0    TOTAL POP.=   25783.    ALL WKRS BY WK-PLACE=   9811.
NO. = 34    SA =  34.0    TOTAL POP.=    5896.    ALL WKRS BY WK-PLACE=   2522.
NO. = 35    SA =  35.0    TOTAL POP.=  169018.    ALL WKRS BY WK-PLACE=  38316.
NO. = 36    SA =  36.0    TOTAL POP.=  180940.    ALL WKRS BY WK-PLACE=  93682.
NO. = 37    SA =  37.0    TOTAL POP.=  319294.    ALL WKRS BY WK-PLACE= 113979.
NO. = 38    SA =  38.0    TOTAL POP.=  271683.    ALL WKRS BY WK-PLACE=  54943.
NO. = 39    SA =  39.0    TOTAL POP.=  188173.    ALL WKRS BY WK-PLACE=  91194.
NO. = 40    SA =  40.0    TOTAL POP.=   54049.    ALL WKRS BY WK-PLACE=  13340.
NO. = 41    SA =  41.0    TOTAL POP.=   49087.    ALL WKRS BY WK-PLACE=  11208.
NO. = 42    SA =  42.0    TOTAL POP.=  289769.    ALL WKRS BY WK-PLACE= 121713.
NO. = 43    SA =  43.0    TOTAL POP.=   33064.    ALL WKRS BY WK-PLACE=   6134.
NO. = 44    SA =  44.0    TOTAL POP.=   29591.    ALL WKRS BY WK-PLACE=  26656.
NO. = 45    SA =  45.0    TOTAL POP.=   39304.    ALL WKRS BY WK-PLACE=   7687.
NO. = 46    SA =  46.0    TOTAL POP.=  239475.    ALL WKRS BY WK-PLACE=  83206.
NO. = 47    SA =  47.0    TOTAL POP.=   25579.    ALL WKRS BY WK-PLACE=   8114.
NO. = 48    SA =  48.0    TOTAL POP.=   41439.    ALL WKRS BY WK-PLACE=  10738.
NO. = 49     SA =    49  0    TOTAL POP.=     13645.          ALL WKRS BY WK-PLACE=    3120.
NO. = 50     SA =    50  0    TOTAL POP.=     27655.          ALL WKRS BY WK-PLACE=    6270.
NO. = 51     SA =    51  0    TOTAL POP.=      3646.          ALL WKRS BY WK-PLACE=     922.
NO. = 52     SA =    52  0    TOTAL POP.=     60708.          ALL WKRS BY WK-PLACE=   19630.
NO. = 53     SA =    53  0    TOTAL POP.=     40902.          ALL WKRS BY WK-PLACE=   15287.
NO. = 54     SA =    54  0    TOTAL POP.=     16469.          ALL WKRS BY WK-PLACE=    7075.
NO. = 55     SA =    55  0    TOTAL POP.=     80623.          ALL WKRS BY WK-PLACE=   30171.
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                     SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

   NRECEP =   58   NRSA =   55   NMONT =   10   NSITES =   10   NPOPL = 1
   NYEAR =    1    SYEAR = 1973.0     DELYR =  2.0     ARSTD =     8.0

                          RECEPTOR SPECIFICATION DATA FOR 1973.0

 NO.=   1  RECEPT NO. =   7 2071   X-Y COORD =   1285.   1610.   TPOPL - WKRPL =   25209.   9781.   AREA =   92.2
 NO.=   2  RECEPT NO. =  12 2121   X-Y COORD =   1361.   1670.   TPOPL - WKRPL =  185595.  68037.   AREA =   48.0
 NO.=   3  RECEPT NO. =  12 2122   X-Y COORD =   1351.   1720.   TPOPL - WKRPL =  185595.  68037.   AREA =   48.0
 NO.=   4  RECEPT NO. =  12 2123   X-Y COORD =   1400.   1630.   TPOPL - WKRPL =  185595.  68037.   AREA =   48.0
 NO.=   5  RECEPT NO. =  13 2131   X-Y COORD =   1485.   1645.   TPOPL - WKRPL =  129615.  68654.   AREA =   20.0
 NO.=   6  RECEPT NO. =  13 2132   X-Y COORD =   1521.   1650.   TPOPL - WKRPL =  129615.  68654.   AREA =   20.0
 NO.=   7  RECEPT NO. =  14 2141   X-Y COORD =   1421.   1730.   TPOPL - WKRPL =  134484.  29279.   AREA =   38.2
 NO.=   8  RECEPT NO. =  14 2142   X-Y COORD =   1510.   1710.   TPOPL - WKRPL =  134484.  29279.   AREA =   38.2
 NO.=   9  RECEPT NO. =  15 2151   X-Y COORD =   1221.   1550.   TPOPL - WKRPL =   14347.   2951.   AREA =   86.9
 NO.=  10  RECEPT NO. =  16 2161   X-Y COORD =   1380.   1570.   TPOPL - WKRPL =  155249.  69134.   AREA =   37.2
 NO.=  11  RECEPT NO. =  16 2162   X-Y COORD =   1430.   1465.   TPOPL - WKRPL =  155249.  69134.   AREA =   37.2
 NO.=  12  RECEPT NO. =  17 2171   X-Y COORD =   1521.   1510.   TPOPL - WKRPL =  183219.  88238.   AREA =   19.4
 NO.=  13  RECEPT NO. =  17 2172   X-Y COORD =   1521.   1560.   TPOPL - WKRPL =  183219.  88238.   AREA =   19.4
 NO.=  14  RECEPT NO. =  17 2173   X-Y COORD =   1521.   1590.   TPOPL - WKRPL =  183219.  88238.   AREA =   19.4
 NO.=  15  RECEPT NO. =  17 2174   X-Y COORD =   1480.   1530.   TPOPL - WKRPL =  183219.  88238.   AREA =   19.4
 NO.=  16  RECEPT NO. =  17 2175   X-Y COORD =   1480.   1580.   TPOPL - WKRPL =  183219.  88238.   AREA =   19.4
 NO.=  17  RECEPT NO. =  18 2181   X-Y COORD =   1521.   1440.   TPOPL - WKRPL =  173419.  85748.   AREA =   22.6
 NO.=  18  RECEPT NO. =  18 2182   X-Y COORD =   1475.   1460.   TPOPL - WKRPL =  173419.  85748.   AREA =   22.6
 NO.=  19  RECEPT NO. =  18 2183   X-Y COORD =   1500.   1410.   TPOPL - WKRPL =  173419.  85748.   AREA =   22.6
 NO.=  20  RECEPT NO. =  19 2191   X-Y COORD =   1505.   1320.   TPOPL - WKRPL =  141488.  50681.   AREA =   31.7
 NO.=  21  RECEPT NO. =  19 2192   X-Y COORD =   1505.   1365.   TPOPL - WKRPL =  141488.  50681.   AREA =   31.7
 NO.=  22  RECEPT NO. =  19 2193   X-Y COORD =   1545.   1350.   TPOPL - WKRPL =  141488.  50681.   AREA =   31.7
 NO.=  23  RECEPT NO. =  20 2201   X-Y COORD =   1595.   1330.   TPOPL - WKRPL =  140465.  64939.   AREA =   20.2
 NO.=  24  RECEPT NO. =  20 2202   X-Y COORD =   1650.   1320.   TPOPL - WKRPL =  140465.  64939.   AREA =   20.2
 NO.=  25  RECEPT NO. =  20 2203   X-Y COORD =   1625.   1390.   TPOPL - WKRPL =  140465.  64939.   AREA =   20.2
 NO.=  26  RECEPT NO. =  21 2211   X-Y COORD =   1565.   1420.   TPOPL - WKRPL =  158188.  96185.   AREA =   20.2
 NO.=  27  RECEPT NO. =  21 2212   X-Y COORD =   1565.   1470.   TPOPL - WKRPL =  158188.  96185.   AREA =   20.2
 NO.=  28  RECEPT NO. =  21 2213   X-Y COORD =   1565.   1520.   TPOPL - WKRPL =  158188.  96185.   AREA =   20.2
 NO.=  29  RECEPT NO. =  21 2214   X-Y COORD =   1610.   1520.   TPOPL - WKRPL =  158188.  96185.   AREA =   20.2
 NO.=  30  RECEPT NO. =  21 2215   X-Y COORD =   1610.   1470.   TPOPL - WKRPL =  158188.  96185.   AREA =   20.2
 NO.=  31  RECEPT NO. =  22 2221   X-Y COORD =   1660.   1420.   TPOPL - WKRPL =  202901.  54674.   AREA =   40.0
 NO.=  32  RECEPT NO. =  22 2222   X-Y COORD =   1690.   1480.   TPOPL - WKRPL =  202901.  54674.   AREA =   40.0
 NO.=  33  RECEPT NO. =  22 2223   X-Y COORD =   1725.   1435.   TPOPL - WKRPL =  202901.  54674.   AREA =   40.0
 NO.=  34  RECEPT NO. =  23 2231   X-Y COORD =   1555.   1545.   TPOPL - WKRPL =   85296.  327291.   AREA =    6.2
 NO.=  35  RECEPT NO. =  24 2241   X-Y COORD =   1561.   1585.   TPOPL - WKRPL =  135708.  47034.   AREA =   23.8
 NO.=  36  RECEPT NO. =  24 2242   X-Y COORD =   1561.   1640.   TPOPL - WKRPL =  135708.  47034.   AREA =   23.8
 NO.=  37  RECEPT NO. =  24 2243   X-Y COORD =   1595.   1595.   TPOPL - WKRPL =  135708.  47034.   AREA =   23.8
 NO.=  38  RECEPT NO. =  25 2251   X-Y COORD =   1641.   1625.   TPOPL - WKRPL =  164838.  61750.   AREA =   36.5
 NO.=  39  RECEPT NO. =  25 2252   X-Y COORD =   1660.   1560.   TPOPL - WKRPL =  164838.  61750.   AREA =   36.5
 NO.=  40  RECEPT NO. =  25 2253   X-Y COORD =   1710.   1555.   TPOPL - WKRPL =  164838.  61750.   AREA =   36.5
 NO.=  41  RECEPT NO. =  25 2254   X-Y COORD =   1730.   1620.   TPOPL - WKRPL =  164838.  61750.   AREA =   36.5
 NO.=  42  RECEPT NO. =  26 2261   X-Y COORD =   1765.   1520.   TPOPL - WKRPL =  153917.  40803.   AREA =   56.7
 NO.=  43  RECEPT NO. =  26 2262   X-Y COORD =   1810.   1595.   TPOPL - WKRPL =  153917.  40803.   AREA =   56.7
 NO.=  44  RECEPT NO. =  26 2263   X-Y COORD =   1840.   1500.   TPOPL - WKRPL =  153917.  40803.   AREA =   56.7
 NO.=  45  RECEPT NO. =  27 2271   X-Y COORD =   1900.   1580.   TPOPL - WKRPL =  150059.  66336.   AREA =   60.0
 NO.=  46  RECEPT NO. =  35 3351   X-Y COORD =   1710.   1355.   TPOPL - WKRPL =  169018.  38316.   AREA =   28.8
 NO.=  47  RECEPT NO. =  36 3361   X-Y COORD =   1800.   1410.   TPOPL - WKRPL =  180940.  93682.   AREA =   45.6
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NO.=  48  RECEPT NO. =  37 3371  X-Y COORD =  1765.  1320.  TPOPL - WKRPL =  159647.  56989.  AREA =   24.9
NO.=  49  RECEPT NO. =  37 3372  X-Y COORD =  1785.  1355.  TPOPL - WKRPL =  159647.  56989.  AREA =   24.9
NO.=  50  RECEPT NO. =  38 3381  X-Y COORD =  1708.  1280.  TPOPL - WKRPL =  135841.  27471.  AREA =   31.2
NO.=  51  RECEPT NO. =  38 3382  X-Y COORD =  1750.  1250.  TPOPL - WKRPL =  135841.  27471.  AREA =   31.2
NO.=  52  RECEPT NO. =  41 3411  X-Y COORD =  1911.  1390.  TPOPL - WKRPL =   49087.  11208.  AREA =  101.0
NO.=  53  RECEPT NO. =  42 3421  X-Y COORD =  1825.  1285.  TPOPL - WKRPL =  144884.  60856.  AREA =   26.1
NO.=  54  RECEPT NO. =  42 3422  X-Y COORD =  1840.  1315.  TPOPL - WKRPL =  144884.  60856.  AREA =   26.1
NO.=  55  RECEPT NO. =  28 4281  X-Y COORD =  1960.  1490.  TPOPL - WKRPL =  122968.  38109.  AREA =  118.0
NO.=  56  RECEPT NO. =  28 4282  X-Y COORD =  2000.  1590.  TPOPL - WKRPL =  122968.  38109.  AREA =  118.0
NO.=  57  RECEPT NO. =  29 4291  X-Y COORD =  2190.  1625.  TPOPL - WKRPL =  151471.  18189.  AREA =  115.5
NO.=  58  RECEPT NO. =  29 4292  X-Y COORD =  2335.  1555.  TPOPL - WKRPL =  151471.  18189.  AREA =  115.5
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                    SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

   NRECEP =   58   NRSA =   55   NMONT =    10   NSITES =    10   NPOPL =  1
   NYEAR =     1     SYEAR =  1973.0     DELYR =  2.0      AQSTD =       8.0

                FREQUENCY DISTRIBUTION OF MONITORED CONCENTRATION      YEAR = 1973.0
P1 P2 P3 P4 P5 P6 P7 P8 = 100/(N+1)  1.0  3.0  5.0 10.0 25.0 50.0 75.0

   1   ST.ID.NO. =    1    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    25.2    18.0    16.0    14.0    10.0     6.4     4.0     2.4
   2   ST.ID.NO. =    2    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    42.0    34.5    29.0    27.5    24.5    17.5     9.0     4.0
   3   ST.ID.NO. =    3    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    32.0    26.0    22.0    20.0    17.0    12.5     7.0     3.5
   4   ST.ID.NO. =    4    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    19.5    12.0     9.0     8.0     6.0     5.0     3.0     2.5
   5   ST.ID.NO. =    5    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    18.5    14.0     9.5     8.5     7.0     5.0     3.0     2.0
   6   ST.ID.NO. =    6    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    38.5    27.0    20.0    18.0    15.0    11.0     6.5     3.0
   7   ST.ID.NO. =    7    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    31.5    30.5    25.5    24.0    20.5    14.5     7.0     3.0
   8   ST.ID.NO. =    8    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    28.3    23.6    22.0    19.5    17.0    13.0     7.0     3.5
   9   ST.ID.NO. =    9    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    33.6    28.8    25.6    23.2    19.2    15.2     5.6     2.4
  10   ST.ID.NO. =   10    0     MAX,P2,P3,P4,P5,P6,P7,P8 %ILE =    29.0    18.5    14.0    12.5    10.5     8.0     5.5     3.5
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                    SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

    NRECEP =    58   NRSA =    55   NMONT =    10   NSITES =    10   NPOL =  1
    NYEAR =     1     SYEAR =  1973.0     DELYR =  2.0     AQSTD =      8.0
                 INTERPOLATED - EXTERPOLATED PERCENTILE CONCENRATIONS AT RECEPTOR SITES      YEAR = 1973.0

  P1 P2 P3 P4 P5 P6 P7 P8 = 100/(N+1)  1.0  3.0  5.0 10.0 25.0 50.0 75.0

    NO. OF VALID MONITORING STATIONS=  10
   NO.=   1     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.9     22.4     19.6     17.5     15.1     11.5     6.6     3.5
   NO.=   2     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.5     23.4     21.6     19.2     15.7     12.7     6.9     3.5
   NO.=   3     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.4     23.6     21.9     19.4     16.9     12.9     7.0     3.5
   NO.=   4     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     29.3     21.9     18.6     16.6     14.2     10.8     6.4     3.5
   NO.=   5     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     32.3     25.0     20.6     18.7     15.8     11.7     6.7     3.4
   NO.=   6     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     32.3     25.7     21.5     19.5     16.6     12.2     6.9     3.5
   NO.=   7     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     29.5     23.7     21.1     18.8     16.3     12.3     6.8     3.5
   NO.=   8     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     32.1     26.0     21.9     19.9     16.9     12.5     7.0     3.5
   NO.=   9     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     26.7     19.2     16.2     14.4     12.2      9.4     5.6     3.3
   NO.=  10     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.1     18.5     14.5     12.9     10.9      8.3     5.5     3.4
   NO.=  11     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     22.4     14.1     10.6      9.4      7.4      5.9     3.7     2.7
   NO.=  12     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     30.8     20.7     15.4     13.8     11.3      8.6     5.2     2.9
   NO.=  13     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     34.4     23.6     17.5     15.7     13.1      9.7     5.9     3.0
   NO.=  14     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     35.0     25.1     19.3     17.4     14.6     10.8     6.4     3.2
   NO.=  15     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.6     18.6     14.0     12.5     10.3      7.9     5.1     3.1
   NO.=  16     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     31.9     22.0     16.9     15.2     12.8      9.6     6.0     3.4
   NO.=  17     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     21.9     14.2     10.5      9.4      7.3      5.8     3.5     2.5
   NO.=  18     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     19.9     12.3      9.2      8.2      6.2      5.1     3.1     2.5
   NO.=  19     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     20.8     13.3      9.8      8.8      6.8      5.4     3.3     2.5
   NO.=  20     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     21.0     14.7     10.4      9.3      7.5      5.6     3.4     2.3
   NO.=  21     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     21.1     14.3     10.3      9.2      7.3      5.6     3.4     2.4
   NO.=  22     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     20.2     14.5     10.2      9.1      7.4      5.4     3.3     2.2
   NO.=  23     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     18.7     14.1      9.6      8.6      7.1      5.1     3.0     2.0
   NO.=  24     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     19.0     14.2      9.9      8.8      7.2      5.1     3.1     2.0
   NO.=  25     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     19.8     14.7     10.1      9.1      7.4      5.4     3.2     2.1
   NO.=  26     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     22.8     15.8     11.4     10.2      8.2      6.2     3.7     2.4
   NO.=  27     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.4     19.5     14.4     12.9     10.5      7.9     4.7     2.6
   NO.=  28     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     36.8     25.6     19.0     17.1     14.2     10.5     6.2     3.0
   NO.=  29     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     35.4     24.7     18.3     16.4     13.6     10.0     5.9     2.9
   NO.=  30     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.9     20.2     14.8     13.3     10.9      8.1     4.8     2.6
   NO.=  31     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     23.6     17.2     12.6     11.3      9.1      6.4     3.9     2.3
   NO.=  32     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     28.6     20.5     15.5     13.8     11.1      7.9     4.7     2.5
   NO.=  33     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     25.5     18.4     14.4     12.8      9.9      6.8     4.1     2.4
   NO.=  34     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     38.1     26.6     19.7     17.8     14.8     10.9     6.4     3.0
   NO.=  35     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     37.4     26.5     19.9     17.9     15.0     11.0     6.5     3.1
   NO.=  36     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     33.5     25.7     20.8     18.8     15.9     11.7     6.7     3.4
   NO.=  37     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     36.9     26.3     19.9     17.9     15.0     11.0     6.5     3.1
   NO.=  38     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     37.1     28.0     22.1     20.2     17.2     12.6     7.1     3.3
   NO.=  39     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     38.1     28.2     21.9     20.0     17.0     12.4     7.0     3.3
   NO.=  40     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     38.5     30.8     24.9     23.2     20.1     14.4     7.6     3.4
   NO.=  41     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     39.7     32.5     26.8     25.2     22.2     15.9     8.2     3.7
   NO.=  42     MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =     34.9     29.8     25.2     23.6     20.2     14.2     7.3     3.3
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NO.=  43   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   40.5   33.8   28.3   26.8   23.7   16.9   8.7   3.8
NO.=  44   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   32.8   29.4   24.8   23.2   19.7   13.9   7.0   3.1
NO.=  45   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   32.1   30.6   25.6   24.1   20.7   14.6   7.1   3.1
NO.=  46   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   22.9   16.7   13.0   11.5    8.9    6.1   3.7   2.2
NO.=  47   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   25.4   19.3   16.6   14.8   11.1    7.4   4.3   2.4
NO.=  48   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   24.6   18.0   15.6   13.7   10.1    6.6   4.0   2.4
NO.=  49   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   25.0   18.2   15.9   14.0   10.2    6.6   4.0   2.4
NO.=  50   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   21.3   15.5   12.1   10.7    8.2    5.6   3.4   2.2
NO.=  51   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   23.7   17.7   14.8   13.1    9.9    6.6   3.9   2.3
NO.=  52   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   25.9   18.9   16.4   14.6   10.9    7.1   4.3   2.5
NO.=  53   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   25.1   18.2   16.0   14.0   10.2    6.6   4.1   2.4
NO.=  54   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   25.2   18.0   16.0   14.0   10.0    6.4   4.0   2.4
NO.=  55   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   32.7   30.4   25.5   24.0   20.5   14.5   7.1   3.1
NO.=  56   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   34.0   31.3   26.3   24.7   21.3   15.2   7.3   3.2
NO.=  57   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   34.1   29.6   25.9   23.7   19.9   15.3   6.1   2.6
NO.=  58   MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =   33.7   28.9   25.6   23.3   19.3   15.2   5.7   2.4
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                    SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

      NRECEP =    58   NRSA =    55   NMONT =    10   NSITES =    10   NPOPL =  1
      NYEAR =     1     SYEAR =  1973.0      DELYR =  2.0       AQSTD =       8.0

            RISK OF RECEPTOR CONCENTRATION EXCEEDING MULTIPLES OF AQSTD      YEAR = 1973.0

    RECEPTOR NO.=   1      1 STD RISK = 41.8      2 STD RISK =   7.7      3 STD RISK =    .3      4 STD RISK =    .0
    RECEPTOR NO.=   2      1 STD RISK = 44.0      2 STD RISK =  11.7      3 STD RISK =    .6      4 STD RISK =    .0
    RECEPTOR NO.=   3      1 STD RISK = 44.4      2 STD RISK =  12.3      3 STD RISK =    .7      4 STD RISK =    .0
    RECEPTOR NO.=   4      1 STD RISK = 38.7      2 STD RISK =   6.0      3 STD RISK =    .3      4 STD RISK =    .0
    RECEPTOR NO.=   5      1 STD RISK = 41.8      2 STD RISK =   9.5      3 STD RISK =   1.3      4 STD RISK =    .0
    RECEPTOR NO.=   6      1 STD RISK = 43.3      2 STD RISK =  11.3      3 STD RISK =   1.6      4 STD RISK =    .0
    RECEPTOR NO.=   7      1 STD RISK = 43.1      2 STD RISK =  10.6      3 STD RISK =    .8      4 STD RISK =    .0
    RECEPTOR NO.=   8      1 STD RISK = 44.0      2 STD RISK =  12.1      3 STD RISK =   1.7      4 STD RISK =    .0
    RECEPTOR NO.=   9      1 STD RISK = 32.3      2 STD RISK =   3.2      3 STD RISK =    .1      4 STD RISK =    .0
    RECEPTOR NO.=  10      1 STD RISK = 27.0      2 STD RISK =   2.0      3 STD RISK =    .1      4 STD RISK =    .0
    RECEPTOR NO.=  11      1 STD RISK =  8.1      2 STD RISK =    .4      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  12      1 STD RISK = 28.1      2 STD RISK =   2.7      3 STD RISK =    .2      4 STD RISK =    .0
    RECEPTOR NO.=  13      1 STD RISK = 34.0      2 STD RISK =   4.6      3 STD RISK =    .8      4 STD RISK =    .0
    RECEPTOR NO.=  14      1 STD RISK = 38.9      2 STD RISK =   7.1      3 STD RISK =   1.2      4 STD RISK =    .0
    RECEPTOR NO.=  15      1 STD RISK = 23.9      2 STD RISK =   1.9      3 STD RISK =    .1      4 STD RISK =    .0
    RECEPTOR NO.=  16      1 STD RISK = 34.0      2 STD RISK =   4.0      3 STD RISK =    .4      4 STD RISK =    .0
    RECEPTOR NO.=  17      1 STD RISK =  7.9      2 STD RISK =    .4      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  18      1 STD RISK =  5.4      2 STD RISK =    .1      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  19      1 STD RISK =  6.5      2 STD RISK =    .2      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  20      1 STD RISK =  8.3      2 STD RISK =    .4      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  21      1 STD RISK =  6.8      2 STD RISK =    .3      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  22      1 STD RISK =  7.8      2 STD RISK =    .3      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  23      1 STD RISK =  6.5      2 STD RISK =    .2      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  24      1 STD RISK =  7.1      2 STD RISK =    .2      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  25      1 STD RISK =  7.9      2 STD RISK =    .3      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  26      1 STD RISK = 11.0      2 STD RISK =    .9      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  27      1 STD RISK = 23.9      2 STD RISK =   2.1      3 STD RISK =    .1      4 STD RISK =    .0
    RECEPTOR NO.=  28      1 STD RISK = 37.4      2 STD RISK =   6.5      3 STD RISK =   1.3      4 STD RISK =    .1
    RECEPTOR NO.=  29      1 STD RISK = 35.3      2 STD RISK =   5.6      3 STD RISK =   1.1      4 STD RISK =    .0
    RECEPTOR NO.=  30      1 STD RISK = 25.4      2 STD RISK =   2.3      3 STD RISK =    .1      4 STD RISK =    .0
    RECEPTOR NO.=  31      1 STD RISK = 14.5      2 STD RISK =   1.3      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  32      1 STD RISK = 24.3      2 STD RISK =   2.7      3 STD RISK =    .1      4 STD RISK =    .0
    RECEPTOR NO.=  33      1 STD RISK = 17.7      2 STD RISK =   1.9      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  34      1 STD RISK = 39.1      2 STD RISK =   7.5      3 STD RISK =   1.5      4 STD RISK =    .1
    RECEPTOR NO.=  35      1 STD RISK = 39.6      2 STD RISK =   7.8      3 STD RISK =   1.5      4 STD RISK =    .1
    RECEPTOR NO.=  36      1 STD RISK = 41.9      2 STD RISK =   9.8      3 STD RISK =   1.5      4 STD RISK =    .0
    RECEPTOR NO.=  37      1 STD RISK = 39.8      2 STD RISK =   7.9      3 STD RISK =   1.5      4 STD RISK =    .1
    RECEPTOR NO.=  38      1 STD RISK = 44.5      2 STD RISK =  12.7      3 STD RISK =   2.1      4 STD RISK =    .1
    RECEPTOR NO.=  39      1 STD RISK = 44.1      2 STD RISK =  12.2      3 STD RISK =   2.1      4 STD RISK =    .2
    RECEPTOR NO.=  40      1 STD RISK = 48.2      2 STD RISK =  19.3      3 STD RISK =   3.9      4 STD RISK =    .5
    RECEPTOR NO.=  41      1 STD RISK = 51.0      2 STD RISK =  24.5      3 STD RISK =   6.6      4 STD RISK =   1.1
    RECEPTOR NO.=  42      1 STD RISK = 46.6      2 STD RISK =  19.1      3 STD RISK =   4.4      4 STD RISK =    .1
    RECEPTOR NO.=  43      1 STD RISK = 52.9      2 STD RISK =  27.0      3 STD RISK =   9.4      4 STD RISK =   1.4
    RECEPTOR NO.=  44      1 STD RISK = 45.1      2 STD RISK =  18.0      3 STD RISK =   3.9      4 STD RISK =    .0
    RECEPTOR NO.=  45      1 STD RISK = 46.0      2 STD RISK =  20.3      3 STD RISK =   5.1      4 STD RISK =    .0
    RECEPTOR NO.=  46      1 STD RISK = 13.4      2 STD RISK =   1.2      3 STD RISK =    .0      4 STD RISK =    .0
    RECEPTOR NO.=  47      1 STD RISK = 21.4      2 STD RISK =   3.6      3 STD RISK =    .0      4 STD RISK =    .0
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RECEPTOR NO.=  48    1 STD RISK = 17.2    2 STD RISK =   2.5    3 STD RISK =   .0    4 STD RISK =   .0
RECEPTOR NO.=  49    1 STD RISK = 17.4    2 STD RISK =   2.9    3 STD RISK =   .0    4 STD RISK =   .0
RECEPTOR NO.=  50    1 STD RISK = 10.6    2 STD RISK =    .7    3 STD RISK =   .0    4 STD RISK =   .0
RECEPTOR NO.=  51    1 STD RISK = 16.9    2 STD RISK =   1.9    3 STD RISK =   .0    4 STD RISK =   .0
RECEPTOR NO.=  52    1 STD RISK = 20.2    2 STD RISK =   3.4    3 STD RISK =   .0    4 STD RISK =   .0
RECEPTOR NO.=  53    1 STD RISK = 17.5    2 STD RISK =   3.0    3 STD RISK =   .0    4 STD RISK =   .0
RECEPTOR NO.=  54    1 STD RISK = 16.0    2 STD RISK =   3.0    3 STD RISK =   .0    4 STD RISK =   .0
RECEPTOR NO.=  55    1 STD RISK = 46.1    2 STD RISK =  19.9    3 STD RISK =  4.9    4 STD RISK =   .0
RECEPTOR NO.=  56    1 STD RISK = 47.2    2 STD RISK =  22.3    3 STD RISK =  5.8    4 STD RISK =   .3
RECEPTOR NO.=  57    1 STD RISK = 43.3    2 STD RISK =  21.8    3 STD RISK =  4.7    4 STD RISK =   .1
RECEPTOR NO.=  58    1 STD RISK = 42.2    2 STD RISK =  20.9    3 STD RISK =  4.3    4 STD RISK =   .1
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                    SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

    NRECEP =   58   NRSA =   55   NMONT =   10   NSITES =   10   NPOPL = 1
    NYEAR =     1     SYEAR = 1973.0     DELYR = 2.0     AQSTD =     8.0

          CONCENTTATION FUNCTIONS FOR DATA SET  YEAR =  1973.0   POPL CL = 1   TPOPL =  8709147.     TAREA =    2316.
 P1 P2 P3 P4 P5 P6 P7 P8 = 100/(N+1)  1.0  3.0  5.0 10.0 25.0 50.0 75.0

                    POPULATION AND LAND AREA EXPOSURE FUNCTIONS

                                        LAND AREA                                      POPULATION
                       DISTRIBUTION FUNCTION      FREQUENCY FUNCTION      DISTRIBUTION FUNCTION      FREQUENCY FUNCTION
                            PERCENTILE                PERCENTILE               PERCENTILE                PERCENTILE
                       P2      P5      P7         P2      P5      P7         P2      P5      P7         P2      P5      P7
 CONCENTRATION
    D* =   59.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   57.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   55.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   53.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   51.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   49.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   47.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   45.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   43.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   41.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   39.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   37.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   35.0       .000    .000    .000       .000    .000    .000       .000    .000    .000       .000    .000    .000
    D* =   33.0       .000    .000    .024       .000    .000    .024       .000    .000    .018       .000    .000    .018
    D* =   31.0       .000    .000    .091       .000    .000    .067       .000    .000    .051       .000    .000    .033
    D* =   29.0       .000    .000    .283       .000    .000    .191       .000    .000    .154       .000    .000    .103
    D* =   27.0       .000    .000    .364       .000    .000    .081       .000    .000    .209       .000    .000    .055
    D* =   25.0       .000    .000    .448       .000    .000    .084       .000    .000    .350       .000    .000    .141
    D* =   23.0       .000    .024    .523       .000    .024    .075       .000    .018    .447       .000    .018    .097
    D* =   21.0       .000    .091    .592       .000    .067    .069       .000    .051    .492       .000    .033    .045
    D* =   19.0       .000    .332    .693       .000    .241    .100       .000    .171    .596       .000    .120    .103
    D* =   17.0       .000    .348    .853       .000    .016    .160       .000    .190    .772       .000    .019    .177
    D* =   15.0       .000    .516    .887       .000    .168    .035       .000    .346    .825       .000    .156    .053
    D* =   13.0       .000    .584    .990       .000    .068    .103       .000    .471    .980       .000    .125    .155
    D* =   11.0       .000    .675   1.000       .000    .091    .010       .000    .559   1.000       .000    .088    .020
    D* =    9.0       .000    .853   1.000       .000    .178    .000       .000    .772   1.000       .000    .213    .000
    D* =    7.0       .240    .980   1.000       .240    .128    .000       .157    .960   1.000       .157    .188    .000
    D* =    5.0       .663   1.000   1.000       .423    .020    .000       .554   1.000   1.000       .397    .040    .000
    D* =    3.0      1.000   1.000   1.000       .337    .000    .000      1.000   1.000   1.000       .446    .000    .000
    D* =    1.0      1.000   1.000   1.000       .000    .000    .000      1.000   1.000   1.000       .000    .000    .000

               SPATIAL AVERAGE AIR QUALITY =   5.73  14.78   23.54
                                       POPULATION WEIGHTED AVERAGE AIR QUALITY =   5.36  13.08   21.83
```

```
                         SHORT-TERM POPULATION EXPOSURE MODEL - LOS ANGELES AREA

      NRECEP =   58   NRSA =   55   NMONT =   10   NSITES =   10   NPOPL =  1
      NYEAR =    1    SYEAR =  1973.0    DELYR =  2.0     AQSTD =     8.0

         RISK FUNCTIONS FOR DATA SET    YEAR =  1973.0   POPL CL = 1   TPOPL =  8709147.    TAREA =    2316.

         DISTRIBUTION AND FREQUENCY FUNCTIONS OF RISK AREA AND RISK POPULATION

                                         LAND AREA                                                     POPULATION
 % TIME              DISTRIBUTION FUNCTION           FREQUENCY FUNCTION            DISTRIBUTION FUNCTION            FREQUENCY FUNCTION
 ABOVE                     THRESHOLD.                     THRESHOLD                       THRESHOLD                      THRESHOLD
THRESHOLD          1 STD  2 STD  3 STD  4 STD   1 STD  2 STD  3 STD  4 STD    1 STD  2 STD  3 STD  4 STD    1 STD  2 STD  3 STD  4 STD

  Fe =100.0         .000   .000   .000   .000    .000   .000   .000   .000     .000   .000   .000   .000     .000   .000   .000   .000
  Fe = 90.0         .000   .000   .000   .000    .000   .000   .000   .000     .000   .000   .000   .000     .000   .000   .000   .000
  Fe = 80.0         .000   .000   .000   .000    .000   .000   .000   .000     .000   .000   .000   .000     .000   .000   .000   .000
  Fe = 70.0         .000   .000   .000   .000    .000   .000   .000   .000     .000   .000   .000   .000     .000   .000   .000   .000
  Fe = 60.0         .000   .000   .000   .000    .000   .000   .000   .000     .000   .000   .000   .000     .000   .000   .000   .000
  Fe = 50.0         .040   .000   .000   .000    .040   .000   .000   .000     .037   .000   .000   .000     .037   .000   .000   .000
  Fe = 45.0         .233   .000   .000   .000    .192   .000   .000   .000     .136   .000   .000   .000     .100   .000   .000   .000
  Fe = 40.0         .506   .000   .000   .000    .273   .000   .000   .000     .331   .000   .000   .000     .194   .000   .000   .000
  Fe = 35.0         .576   .000   .000   .000    .070   .000   .000   .000     .450   .000   .000   .000     .120   .000   .000   .000
  Fe = 30.0         .630   .000   .000   .000    .054   .000   .000   .000     .494   .000   .000   .000     .044   .000   .000   .000
  Fe = 25.0         .663   .024   .000   .000    .033   .024   .000   .000     .551   .018   .000   .000     .057   .018   .000   .000
  Fe = 20.0         .761   .217   .000   .000    .098   .192   .000   .000     .640   .103   .000   .000     .089   .085   .000   .000
  Fe = 15.0         .835   .332   .000   .000    .075   .116   .000   .000     .749   .171   .000   .000     .109   .068   .000   .000
  Fe = 12.5         .865   .348   .000   .000    .030   .016   .000   .000     .792   .190   .000   .000     .043   .019   .000   .000
  Fe = 10.0         .887   .447   .000   .000    .022   .099   .000   .000     .825   .297   .000   .000     .034   .107   .000   .000
  Fe =  7.5         .963   .529   .024   .000    .076   .082   .024   .000     .928   .372   .018   .000     .103   .074   .018   .000
  Fe =  5.0        1.000   .576   .117   .000    .037   .047   .093   .000    1.000   .450   .068   .000     .072   .079   .050   .000
  Fe =  3.0        1.000   .704   .332   .000    .000   .129   .215   .000    1.000   .537   .171   .000     .000   .087   .103   .000
  Fe =  1.0        1.000   .865   .457   .040    .000   .161   .125   .040    1.000   .792   .368   .037     .000   .254   .197   .037
  Fe =   .8        1.000   .874   .482   .040    .000   .009   .025   .000    1.000   .810   .405   .037     .000   .018   .036   .000
  Fe =   .5        1.000   .887   .523   .056    .000   .013   .041   .016    1.000   .825   .447   .056     .000   .016   .043   .019
  Fe =   .3        1.000   .963   .572   .107    .000   .076   .048   .051    1.000   .928   .471   .070     .000   .103   .024   .014
  Fe =   .1        1.000  1.000   .635   .176    .000   .037   .064   .069    1.000  1.000   .573   .151     .000   .072   .102   .081
  Fe =   .0        1.000  1.000  1.000  1.000    .000   .000   .365   .824    1.000  1.000  1.000  1.000     .000   .000   .427   .849

          AVERAGE LAND AREA RISK (IN%) = 33.31  10.25  2.00   .17
                                                           AVERAGE POPULATION RISK (IN%) = 28.71  7.14  1.39   .15
```

4.0 COMPUTER GRAPHICS

This section will discuss the use of three computer programs which can be used to produce computer drawn isopleth maps.

4.1 HYBRID Computer Mapping Procedure

A. Description

Hybrid generates a map drawn by a CALCOMP plotter. It also allows the user to preview this map on a Tektronix terminal. The program sorts data values into interval classes and directs the graphics device to plot a corresponding symbol at each data point. The boundries and subregions within the study area are represented by polygons.

B. Input - General Description

1. Control parameters - Card 1
2. Symbols - Card 2
3. Interval classes - Card 3
4. Geographic boundries - The boundries and subareas of the study area are described by polygons. The first card or record specifies the total number of polygons and the number of vertices per polygon. The next cards or records specify the x y coordinates of each polygon. The

---

Hybrid Data Items

Card Column	Variable Type		
		4. Geographic Boundries parameters	
1-2	I	NPOLYG - no. of polygrons	First Card
3-4	I	NPTS(1) - no. of points for polygon 1	
5-6	I	NPTS(2) - no. of points for polygon 2	
7-8	I	NPTS(3) - no. of points for polygon 3	
.	.	. .	
.	.	. .	
.	.	. .	
	I	NPTS(NCNTY) - no. of points for polygon NCNTY	
1-10	F	XPOLYG(I, J)-x coordinate for vertex I in polygon J	subsequent cards
11-20	F	XPOLYG(I, J)-y coordinate for vertex I in polygon J	

C. HYBRID Input Data - List of parameters and record format description

Card Column	Variable Type	Hybrid Data Items	
		1. Control parameters	
	F	XFACT - multiplicative scaling factor which converts input data to inches	
6-10	F	XOFF - transforms x coordinate to $x = x - XOFF$	
11-15	F	YOFF - transforms y coordinate to $y = y - YOFF$	
16-20	F	XWIDTH - width of map in original data units	may be left blank, default=1
21-25	F	CHAR - scaling factor for character symbols	
26-30	I	NPLOT1-no. of first data set to be plotted	used for multiple plots may be left blank for single plot
31-35	I	NPLOT2-no. of last data set to be plotted	
		2. Symbols - used to display classes of data values parameters	
1	A	SYMBOL(1) - Symbol corresponding to class interval	1
2	A	(2) -	2
3	A	(3)	3
4	A	(4)	4
5	A	(5)	5
6	A	(6)	6
7	A	(7)	7
8	A	(8)	8
9	A	(9)	9
10	A	(10)	10
		3. Class intervals - defines categories of data values parameters	
1-5	F	Range(1)-defines class interval 1 as $x >$ Range (1)	
6-10	F	(2) " " " 2 as Range(2) $\leq x <$ Range(1)	
11-15	F	(3) " " " 3 (3) $\leq x <$ (2)	
16-20	F	(4) " " " 4 (4) $\leq x <$ (3)	
21-25	F	(5) " " " 5 (5) $\leq x <$ (4)	
26-30	F	(6) " " " 6 (6) $\leq x <$ (5)	
31-35	F	(7) " " " 7 (7) $\leq x <$ (6)	
36-40	F	(8) " " " 8 (8) $\leq x <$ (7)	
41-45	F	(9) " " " 9 (9) $\leq x <$ (8) defines class interval 10 as $x <$ Range (9)	

Card Column	Variable Type	Hybrid Data Items	
		4. Geographic Boundries	
		parameters	
1-2	I	NPOLYG - no. of polygrons	First Card
3-4	I	NPTS(1) - no. of points for polygon 1	
5-6	I	NPTS(2) - no. of points for polygon 2	
7-8	I	NPTS(3) - no. of points for polygon 3	
.	.	. .	
.	.	. .	
.	.	. .	
	I	NPTS(NCNTY) - no. of points for polygon NCNTY	
1-10	F	XPOLYG(I, J)-x coordinate for vertex I in polygon J	subsequent cards
11-20	F	XPOLYG(I, J)-y coordinate for vertex I in polygon J	
		5. Display Variable-This data can be provided by output files of LPEM and SPEM	
		parameters	
1-3	I	no. of points	first card or record
1-10	F	data value	
11-20	F	x coordinate	one card or record for each point
21-30	F	y coordinate	

D. Sample Run Streams

1. Sample run stream for CALCOMP generated map on UNIVAC

```
@ ASG,CP    user plot file
@ ASG,A     TRRP*POPEXP.
@ PLOT      user plot file
@ XQT       TRRP*POPEXP.HYBRID/CAL
@ ADD       TRRP*POPEXP.HYBRID-DATA/LA
@ FREE      user plot file.
@ SYM       user plot file.,,PLOT
@ FIN
```

2. Sample Run Stream for Tektronix Generated Map on UNIVAC

Enter the following commands at your terminal:

```
@ ASG,A  TRRP*POPEXP.

@ XQT   TRRP*POPEXP.HYBRID/TEK
@ ADD   TRRP*POPEXP.HYBRID-DATA /LA
```

You will now be in CALCOMP Preview Mode.

CALCOMP preview on Tektronix requires the use of Tektronix supplied previewing routines. These are referenced in "Preview Routines for CALCOMP Plotters, Users Manual." The following input statements will allow the user to preview the sample map on Tektronix. The questions are generated by CALCOMP preview software.

```
OPTION?
1 (press Return)
OPTION?
W (press Return)
WHERE WOULD YOU LIKE ORIGIN(X,Y)
-3.,1.  (press Return)  (or   -6,0)
ENTER SIZE (WIDTH,HEIGHT)
7.,5.7                  (or  14, 11.4)
OPTION?
C   (press Return)
```

Usual values of the origin (x,y) are 0,0. Negative values are used here because the data coordinates became negative through re-scaling by the program. The size (width, height) specifies the portion of the apparent calcomp plot that is to be viewed on the tektronix screen. The ratio of width and height must match the actual CRT viewing dimensions.

F. Application of HYBRID Maps

It is recommended that HYBRID be applied once to the air quality data observed at the monitoring sites and separately to air quality data estimated at a receptor network. The combined use of both of these generated maps will facilitate the development of a suitable isopleth map. The monitoring data map will show actual observed values while the receptor data map will provide estimates for areas between the monitoring sites. A suggested approach is to overlay the monitoring data map on top of the receptor data map, so that both maps can be visually combined. The use of two separate maps will allow the user to easily discriminate between actual monitoring data and the interpolated estimates from the monitoring data. The values estimated at the receptor network reflect an averaging process and may therefore be quite different than the monitoring data in areas of variable air quality. This apparent discrepancy may be viewed as a localized condition and may require the inclusion of a separate isopleth on the map.

For the preparation of the isopleth map from the HYBRID generated map, it is suggested that 5 or less isopleth levels be used. This will produce a visually pleasing map. Usually, an isopleth corresponding to the NAAQS is used. The selection of additional isopleth values is guided by the observed data values. Isopleth lines are manually drawn between symbols which denote data class intervals above and below the particular isopleth level. Suppose that symbol 7 denotes values of 70-79 $\mu g/m^3$, symbol 8 denotes values of 80-89 $\mu g/m^3$ and symbol 9 denotes values of 90-99 $\mu g/m^3$. An isopleth line for 80 $\mu g/m^3$ would be drawn so that it is equidistant between adjacent symbols 7 and 8. If symbols 7 and 9 are adjacent, the isopleth lines would be placed one third the distance between 7 and 9.

4.2 SYMAP

A. SYMAP allows the user to generate printed maps on a line printer with overprint capability. The SYMAP computer graphics program allows even those with limited experience in programming to produce several types of maps by using basic SYMAP packages with various electives. Directions for the programming of these maps may be obtained from the "SYMAP User's Reference Manual" developed at Harvard University. However, a beginning user of SYMAP may find it helpful to see other examples of SYMAP. The following material contains basic run commands and instructions for six example maps produced by SYMAP. Each map uses 1972 annual geometric mean TSP concentrations produced by 122 monitors in the N.Y.-N.J.-Ct AQCR to illustrate potentially useful spatial displays of air quality. These examples may be aids in setting up your own SYMAP package.

References:

1. "EPA GRAPHICS USERS GUIDE HARVARD GRAPHICS USER INFORMATION", Rodney H. Allen, Comp-Aid Inc., July 1975, revised January 1976.

2. "SYMAP User's Reference Manual", James A. Dougenik and David E. Sheehan, Laboratory for Computer Graphics and Spatial Analysis, Graduate School of Design, Harvard University, 1975, revised May 1976.

B. Generation of Sample SYMAPexamples

```
@ ASG,A  GRAPH* HARVARD
@ ASG,A  TRRP* SYMAP-DATA
@ ASG,A  TRRP* POPEXP.

@ HDG, NX  X·M, 66, 0, 0

@ XQT  GRAPH* HARVARD·SYMAP
@ ADD TRRP* POPEXP;SYMAP1

@ XQT GRAPH* HARVARD;SYMAP
@ ADD TRRP* POPEXP. SYMAP2

@ XQT  GRAPH* HARVARD.SYMAP
@ ADD  TRRP* POPEXP. SYMAP3

@ XQT GRAPH* HARVARD.SYMAP
@ ADD TRRP*  POPEXP.SYMAP4
```

(1) TRRP * POPEXP. SYMAP1 contains the data statements required to generate conformant maps (example 1 and 2)

(2) TRRP * POPEXP. SYMAP2 contains the data statements required to generate contour maps (example maps 3,4)

(3) TRRP * POPEXP. SYMAP3 contains the data statements required to generate a contour map with Barriers (example Map 5)

(4) TRRP*POPEXP. SYMAP4 contains the data statements required to generate a proximal map. (example map 6)

C. Preparation of Data

The boundary of the study region can be represented by a polygon. Seperate subareas such as counties can be included. After the specific area and boundries have been established, the map should be placed on a coordinate system with the origin in the upper left corner. An example base map is shown in Figure 4.2-1. The vertices of each "subarea" are then put on cards or into a file. They will be used in the A-OUTLINE and A-CONFORMOLINES package according to the format specifications.

Data points must then be selected which will be used for the location of values. The coordinates for these points should be determined. These points will be used in the B-DATA POINTS package and may also be put on cards or into a file.

After the data points are chosen, values must be assigned for each point. The values will be used in the E-VALUES package.

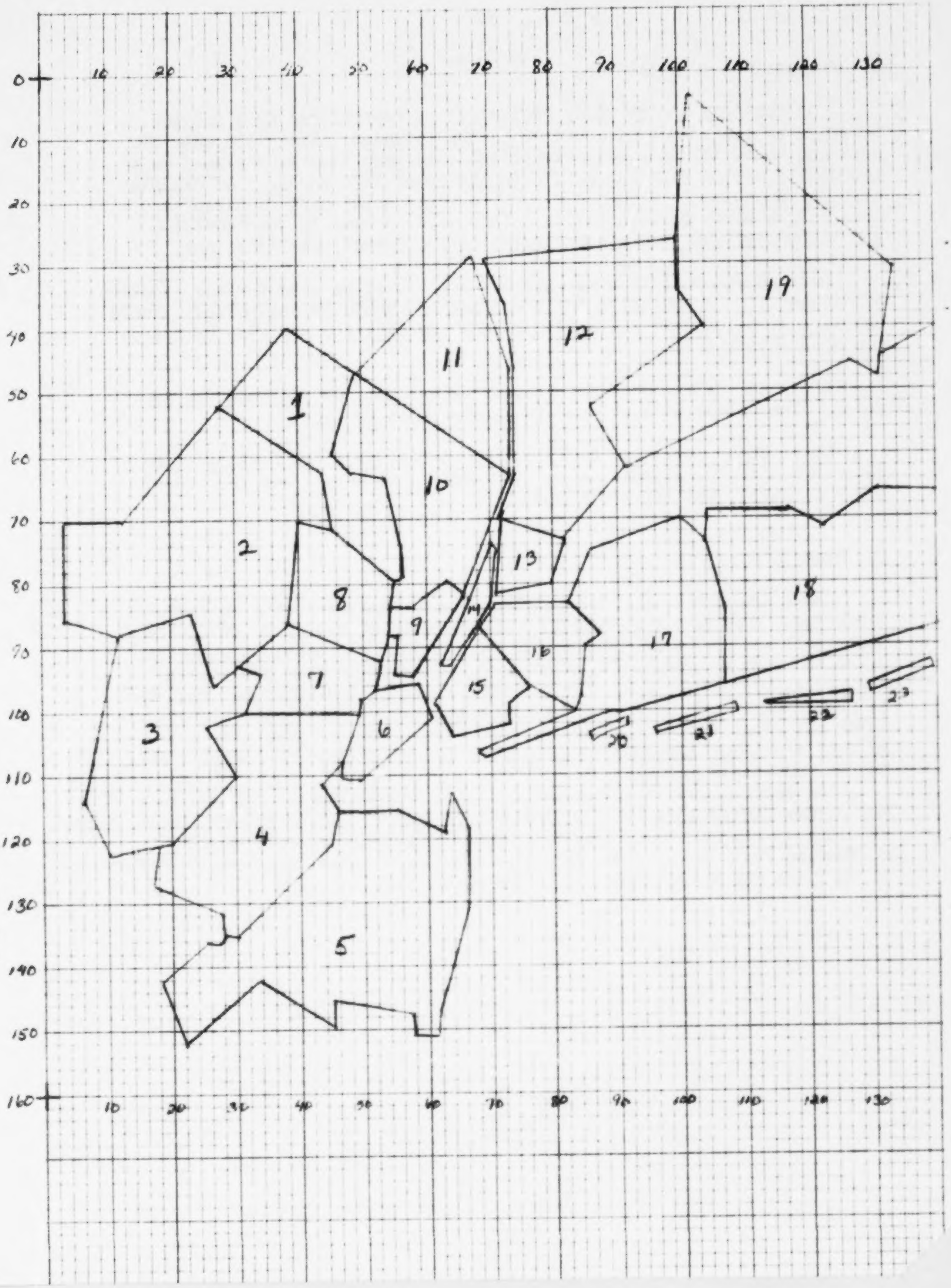
Three other packages: C-OTOLEGENDS, D-BARRIERS, AND F-MAP will be described with the example maps. For additional detail and the use of other packages, see the SYMAP manual.

D. Example Maps

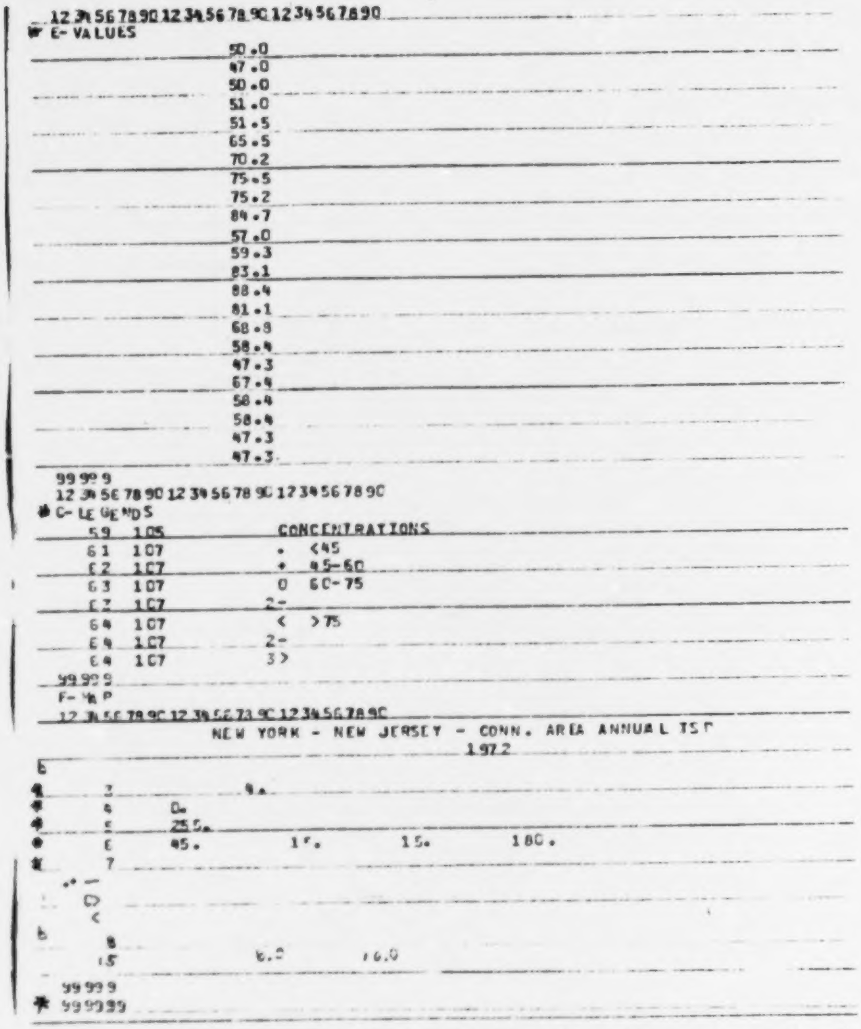
There are three basic types of maps shown in the following examples Conformant, Contour, and Proximal. The conformant map is based on the "subareas" set up in the A-CONFORMOLINES package and displays a single value for each subarea. The other examples here, contour and proximal, use the A-OUTLINE package. Contour maps are of a continous nature. The values at each data point are used to produce continous interval patterns which are displayed as contours or isopleths. Proximal maps are produced so that the value assigned to each point is chosen from the nearest data point (monitoring site).

The maps in the following example show the outline of the New York New Jersey Connecticut Air Quality Control Region. The area was divided into sections by counties and islands. Total Suspended Particulate (TSP) monitoring locations are the data points and TSP annual mean concentrations in 1972 are the values used. (See Section 4.2-E)

Figure 4.2-1 Map Used to Find Coordinates for Various Packages in this Program


0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

-Example 2



```
 123456789012345678901234567890
*E-VALUES
                       50.0
                       47.0
                       50.0
                       51.0
                       51.5
                       65.5
                       70.2
                       75.5
                       75.2
                       84.7
                       57.0
                       59.3
                       83.1
                       88.4
                       81.1
                       68.8
                       58.4
                       47.3
                       67.4
                       58.4
                       58.4
                       47.3
                       47.3
 99999
 123456789012345678901234567890
*C-LEGENDS
   59  105          CONCENTRATIONS
   61  107          .  <45
   62  107          +  45-60
   63  107          0  60-75
   63  107         2-
   64  107          <  >75
   64  107         2-
   64  107         3>
 99999
 F-MAP
 123456789012345678901234567890
              NEW YORK - NEW JERSEY - CONN. AREA ANNUAL TSP
                                  1972
b
*   3          4.
*   4    0.
*   5    255.
*   6    45.        15.        15.        180.
*   7
 .+ -
   O>
   <
b
    8
   15          6.0        16.0
 99999
*999999
```

2. Conformant map which assigns a single value to each county (average TSP from the monitors in each county). Produced in the same run as the previous map. Packages are repeated for each new map until a new one is found in the program.

   *1234567890...are column numbers placed in the list for your convenience. Do not put these in program.

   *E-VALUES are averages from each county or island. They are listed in the same sequence as the counties and islands.

   *C-LEGENDS are in row-column coordinates. An over-printed character was created by placing a "2" or "3" in column 20.

   *Elective 3 designates the number of class intervals.

   *Elective 4 sets a minimum value for range.

   *Elective 5 sets a maximum value for range.

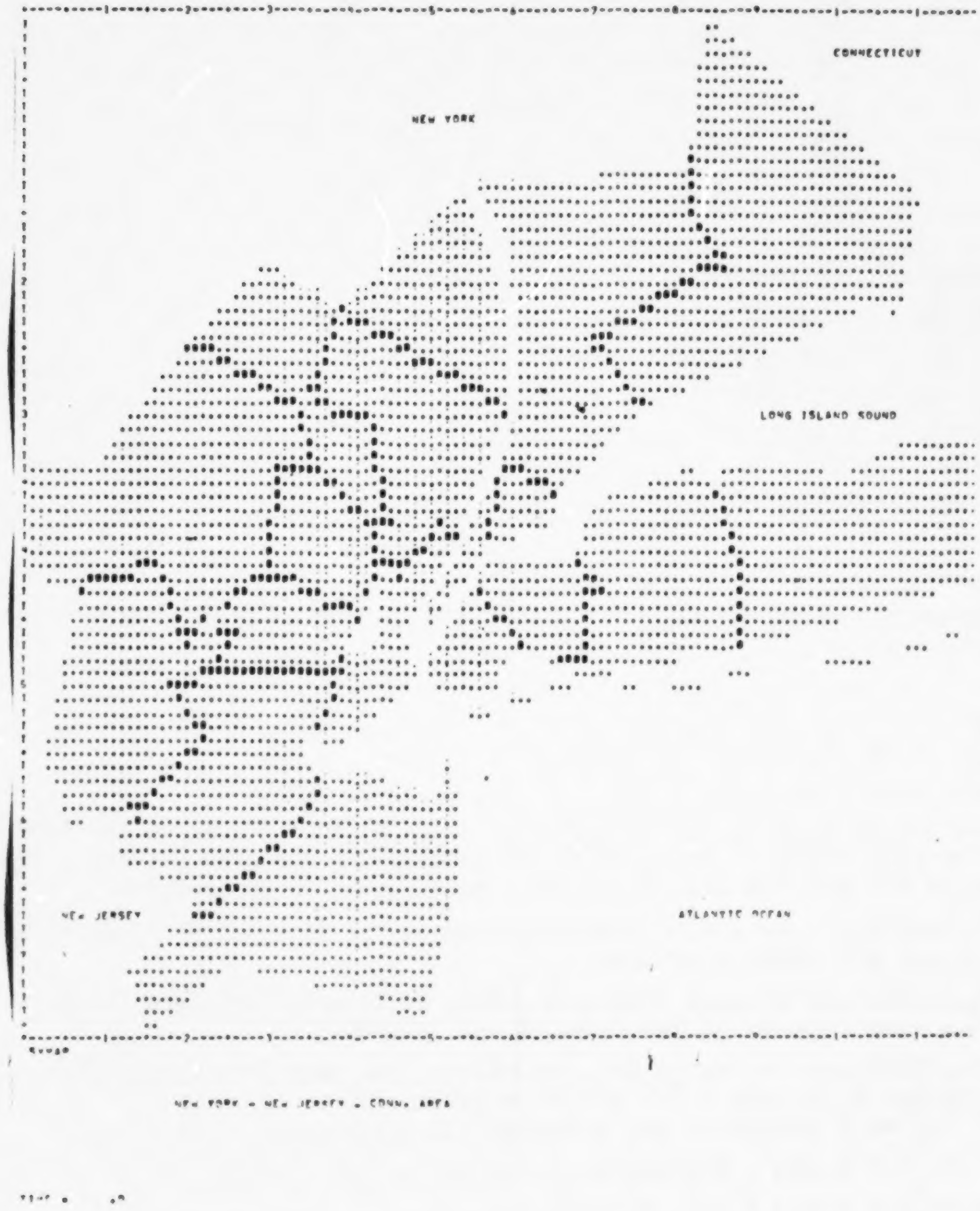
   *Elective 6 sets the class intervals. In this example, the intervals will be 0-45, 46-60, 61-75, 76-255.

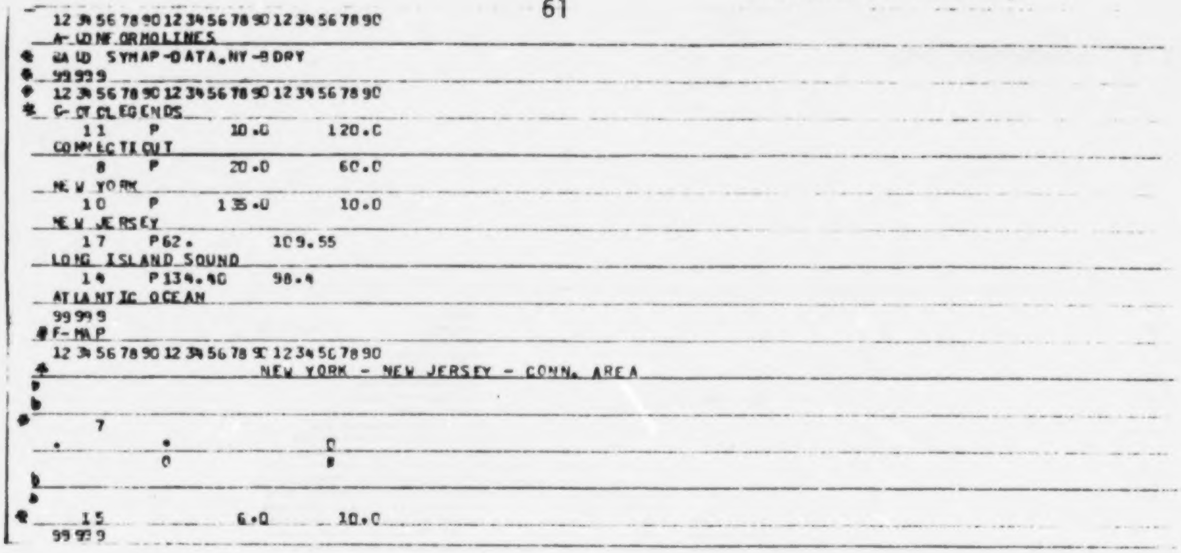
   *Elective 7 defines character symbols for each interval.

   *999999 must be placed at the end of each run to finish the program.

   bBlank card

Map 1. Conformant Base Map


CONNECTICUT
NEW YORK
LONG ISLAND SOUND
NEW JERSEY
ATLANTIC OCEAN
SYMAP
NEW YORK - NEW JERSEY - CONN. AREA
TIME =



```
  123456789012345678901234567890
  A-CONFORMOLINES
* 4A ID SYMAP-DATA.NY-BDRY
* 99999
* 123456789012345678901234567890
* C-OTOLEGENDS
    11    P        10.0      120.0
  CONNECTICUT
     8    P        20.0       60.0
  NEW YORK
    10    P       135.0       10.0
  NEW JERSEY
    17    P62.          109.55
  LONG ISLAND SOUND
    14    P134.40    98.4
  ATLANTIC OCEAN
  99999
* F-MAP
  123456789012345678901234567890
*                     NEW YORK - NEW JERSEY - CONN. AREA
b
b
*    7
  .       .          D
          O          #
b
b
*   15           6.0      10.0
  99999
```

Example 1. Simple conformant map showing county boundaries.

*1234567890...are placed in the list for your convenience. Column numbers--<u>do</u> <u>not</u> put these in program.

*SYMAP-DATA.NY-BDRY is a file containing the vertices of each sub-area polygon. (See 4.2.E)

*99999 must be placed after all packages.

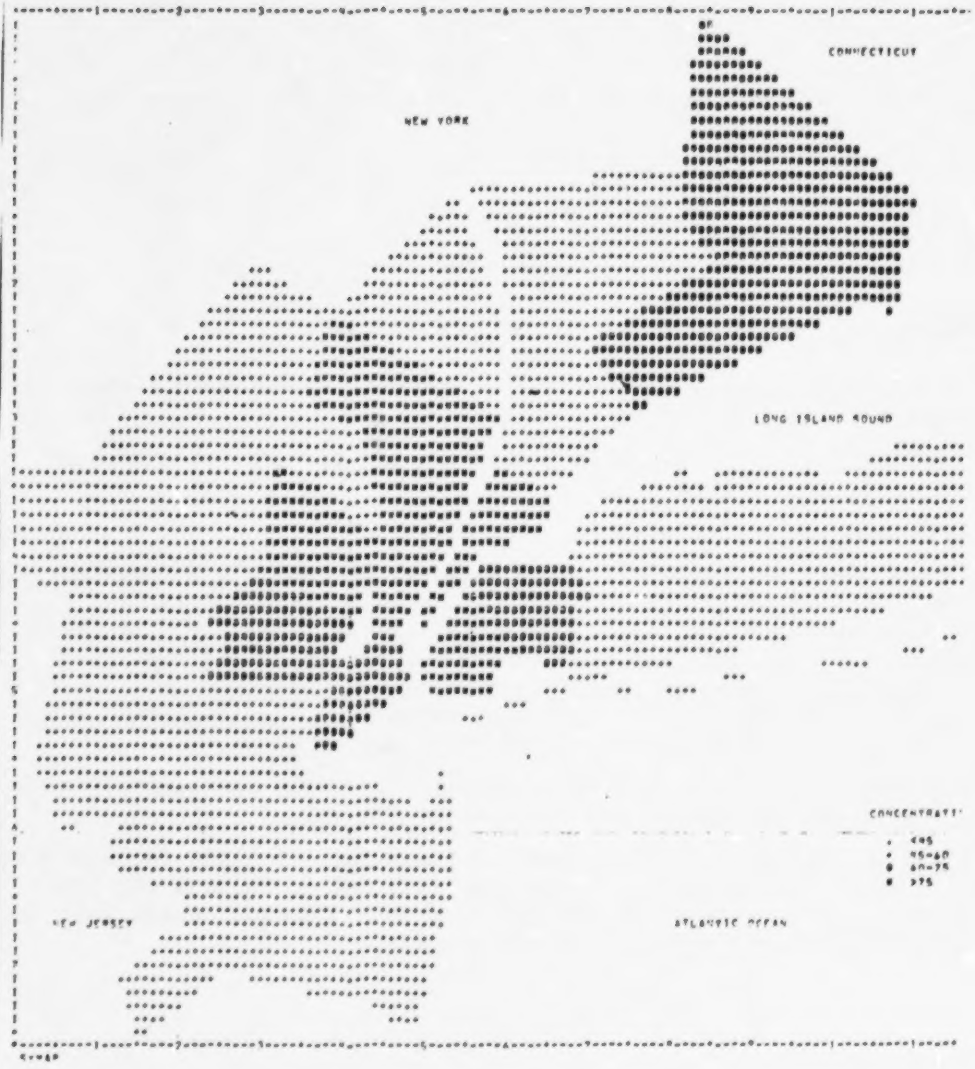
*The C-OTOLEGENDS package is used here to place labels for states and bodies of water on the map. Specifications on the cards include the number of spaces required for the label, type of oto-legend ('P', point), and the coordinates for the first character in the label. Use map coordinates. The F-MAP package specifies map options or electives. After the heading F-MAP, three title cards are inserted. Any of these may be blank.

*Elective 7 specifies symbols (single or overprint characters) which are used for boundaries and interior of the map.

*Elective 15 notifies the program of the number of lines to be printed per inch. The default is 8 rows per inch and 10 columns per inch; however, all printers are not set to print this way. Check your printer to see if changes need to be made.

[b] Blank card

Map 2. Conformant Map


CONNECTICUT
NEW YORK
LONG ISLAND SOUND
CONCENTRATI
<45
45-60
60-75
>75
NEW JERSEY
ATLANTIC OCEAN
SYMAP

NEW YORK - NEW JERSEY - CONN. AREA ANNUAL TSP

1977

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```
*A-OUTLINE          X
 @ADD SYMAP-DATA.NY-BDRY
 99999
*B-DATA POINTS      XX
 @ADD SYMAP-DATA.NY-72C-B
 99999
 C-OTOLEGENDS       X
   11   P      10.0      120.0
 CONNECTICUT
    8   P      20.0       60.0
 NEW YORK
   10   P     135.0       10.0
 NEW JERSEY
   17   P62.        109.55
 LONG ISLAND SOUND
   14   P134.40    98.4
 ATLANTIC OCEAN
 99999
 C-LEGENDS          XX
    72  105         CONCENTRATIONS
    74  107         .  <45
    75  107         +  45-60
    76  107         0  60-75
    76  107        2-
    77  107         <  >75
    77  107        2-
    77  107        3>
 99999
*E-VALUES           X
 @ADD SYMAP-DATA.NY-72C-E
 99999
 F-MAP
 123456789012345678901234567890
                NEW YORK - NEW JERSEY - CONN. AREA ANNUAL TSP
                                              1972
D
     3              4.
     4      0.
     5      255.
     6      45.       15.       15.       180.
*    7
   -        1234          -
    O
    <
*    8
*    9
*   17
*   36      3.        3.
 99999
```

The next two maps will use basically the same format, therefore, only the changes will be specified for the second map.

3. Contour map with four class intervals.

*1234567890...are column numbers placed in the list for your convenience. Do not put in program.

*A-OUTLINE--used for contour and proximal maps. A character (x) in columns 21-30 will delete print-out of the package.

*B-DATA POINTS are also on a file.

*E-VALUES are on a file. (See 4.2-E)

*Elective 7 defines characters for each interval and numbers the intervals at the data points on the map. In column 27(-) will not be used in this map, but in the next map.

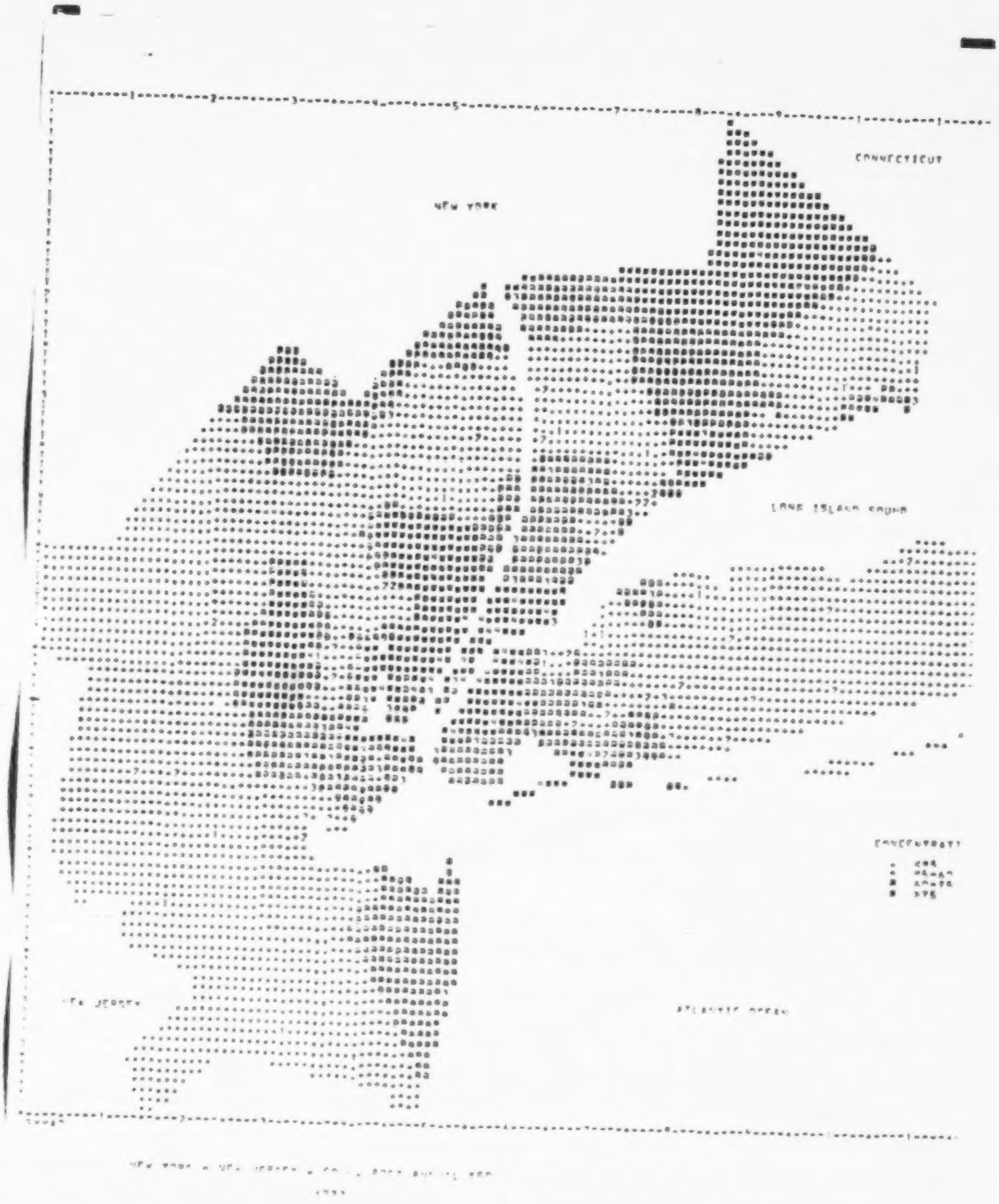
*Elective 8 allows continuous contours to be produced. Otherwise, a blank space indicating a contour line would appear between class intervals.

*Elective 9 suppresses a histogram which will be printed after each map showing the distribution of values within each interval.

*Elective 17 stops a printout of data point information preceding the map. This information is of little value after it has been printed out once.

*Elective 36 sets the number of values one wiches to have for interpolation at each data point.

Map 3. Contour Map


CONNECTICUT
NEW YORK
LONG ISLAND SOUND
CONCENTRATI
NEW JERSEY
ATLANTIC OCEAN

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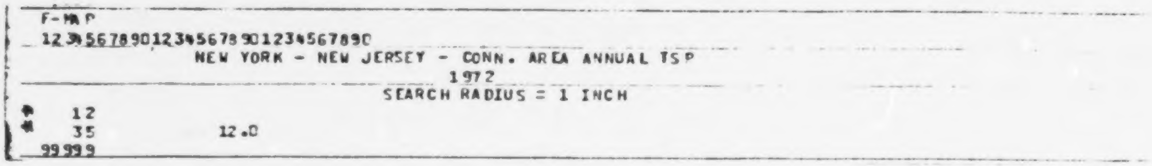
-Example 4

Contour Map with Search Radius

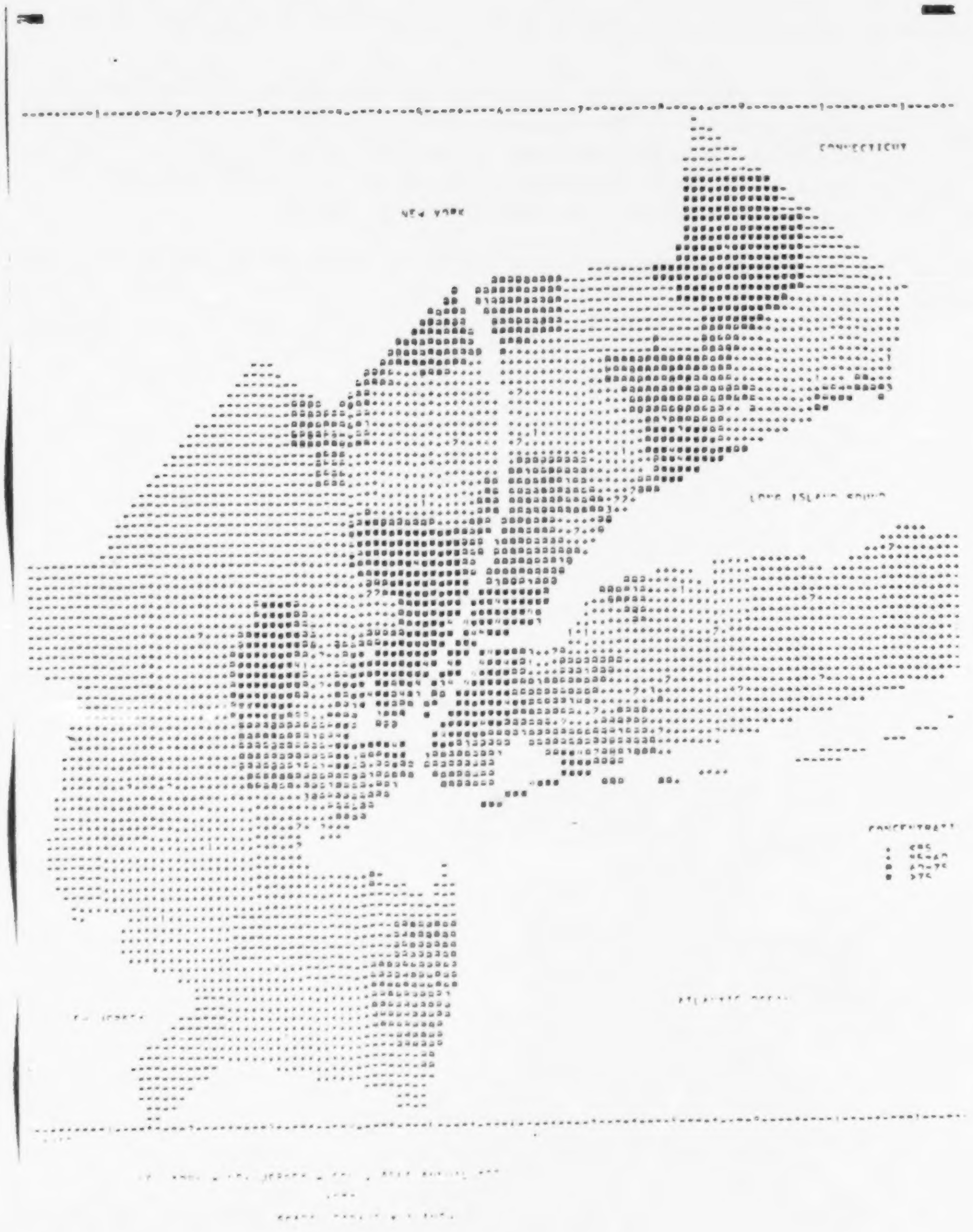


```
F-MAP
1234567890123456789012345678890
                    NEW YORK - NEW JERSEY - CONN. AREA ANNUAL TSP
                                       1972
                                  SEARCH RADIUS = 1 INCH
    12
    35            12.0
99999
```

4. This map is the same as the previous map with the exception of Elective 35 and is produced by adding another F-MAP package with elective 12 (repeats electives of previous map)and elective 35 which defines a one-inch search radius. The program will not go beyond one inch from each data point to search for data. The symbol (-) will appear outside of the search radius range.

1234567890...are column numbers placed in the list for your convenience. Do not put these in your program.

Map 4. Countour Map with 1 Inch Search Radius


CONNECTICUT
NEW YORK
LONG ISLAND SOUND
CONCENTRATI
NEW JERSEY
ATLANTIC OCEAN

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Example 5

```
A-OUTLINE            X
@ADD SYMAP-DATA.NY-BDRY
99999
B-DATA POINTS        XX
@ADD SYMAP-DATA.NY-72G-B
99999
C-OTOLEGENDS         X
  11   P      10.0      120.0
CONNECTICUT
   8   P      20.0       60.0
NEW YORK
  10   P     135.0       10.0
NEW JERSEY
  17   P62.          109.55
LONG ISLAND SOUND
  14   P134.40      98.4
ATLANTIC OCEAN
99999
C-LEGENDS            XX
   72  105           CONCENTRATIONS
   74  107           .  <45
   75  107           +  45-60
   76  107           0  60-75
   76  107          2-
   77  107           <  >75
   77  107          2-
   77  107          3>
99999
1234567890123456789012345678900
D-BARRIERS            XX
             40.0     38.0     -1.0
             62.      72.      -1.0
             67.      72.      -1.0
             72.      71.      -1.0
             89.      63.      -1.0
             94.      60.      -1.0
99999
E-VALUES             X
@ADD SYMAP-DATA.NY-72G-E
99999
F-MAP
1234567890123456789012345678900
                NEW YORK - NEW JERSEY - CONN. AREA ANNUAL TSP
                                      1972
b
     3              4.
     4      0.
     5      255.
     6      45.         15.         15.         180.
     7
 .+-        1234             -
    0>
    <
b
     8
     9
    17
    30      3.        3.
99999
999999
```

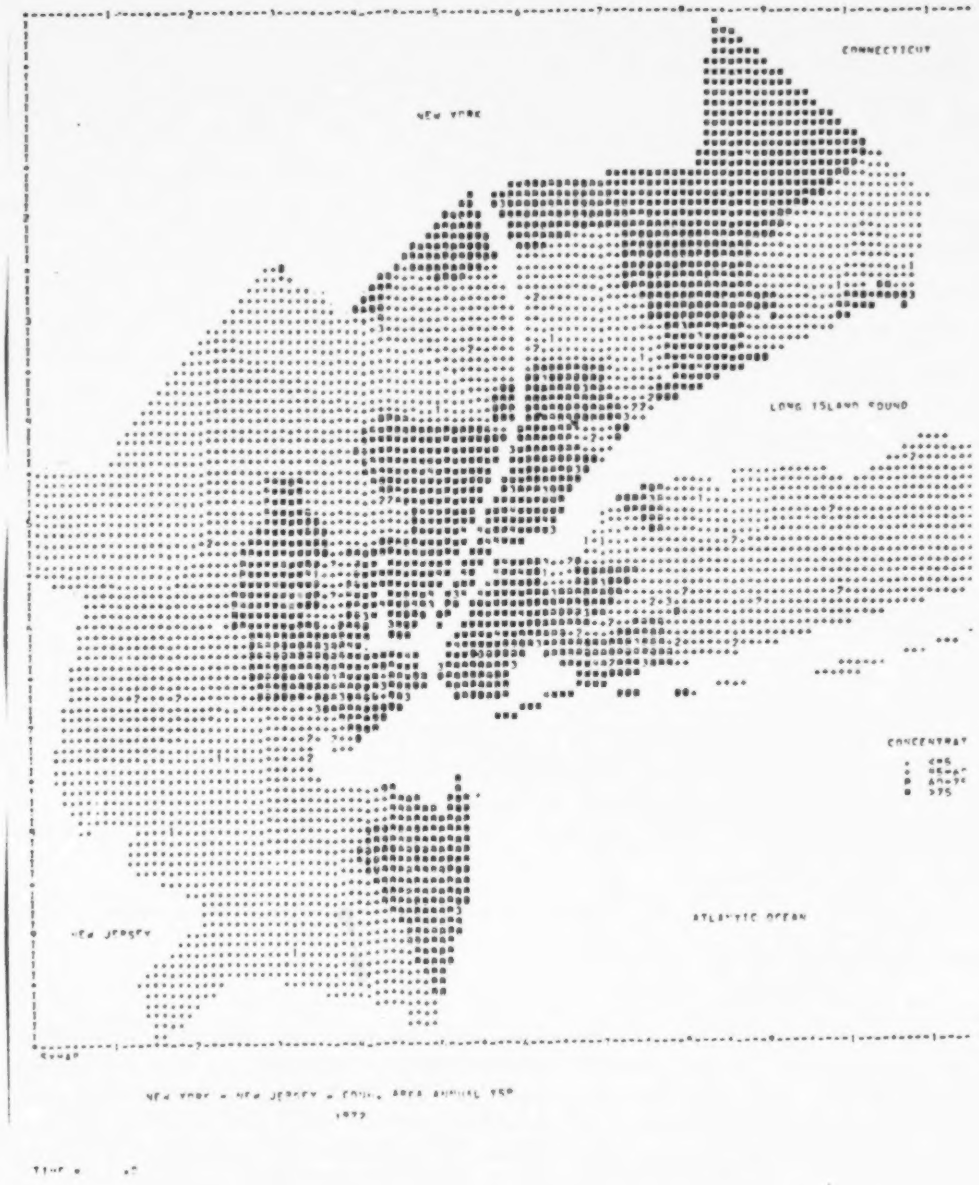
5. This map uses the same package as the previous map as well as the same electives with the exception of elective 35 (no search radius used). However, a new package, D-BARRIERS, has been added. The barrier is along the New York-New Jersey state line so that the values in either state close to the barrier will not effect the interpolated values in the other state. The first two columns of numbers are the coordinates for the vertices of the barrier. This is an impermeable barrier and is designated as such by (-1.0).

1234567890...are column numbers placed in the list for your convenience. <u>Do not</u> put these in your program.

---

[b] Blank card

Map 5. Contour Map with Barrier


CONNECTICUT
NEW YORK
LONG ISLAND SOUND
CONCENTRAT
<65
65-70
70-75
>75
ATLANTIC OCEAN
NEW JERSEY
NEW YORK - NEW JERSEY - CONN. AREA ANNUAL TSP
1972

```
   A-OUTLINE                   X
   @A ID SYMAP-DATA.NY-BDRY
   99999
   B-DATA POINTS               XX
   @A ID SYMAP-DATA.NY-72G-B
   99999
   1234567890123456789012345678 90
   C-OTOLEGENDS                X
      11     P         10.0       120.0
   CONNECTICUT
       8     P         20.0        60.0
   NEW YORK
      10     P        135.0        10.0
   NEW JERSEY
      17     P62.              109.55
   LONG ISLAND SOUND
      14     P134.40           98.4
   ATLANTIC OCEAN
   99999
   123456789012345678901234567890
   D-LEGENDS                   XX
      72  105                  CONCENTRATIONS
      74  107                  .  <45
      75  107                  +  45-60
      76  107                  0  60-75
      76  107                 2-
      77  107                  <  >75
      77  107                 2-
      77  107                 3>
   99999
   E-VALUES                    X
   @A ID SYMAP-DATA.NY-72G-E
   99999
   F-MAP
   123456789012345678901234567890
                    NEW YORK - NEW JERSEY - CONN. AREA ANNUAL TSP
                                          1972
b
        3                4.
        4     0.
        5     255.
        6     45.       15.       15.       180.
        7
 .+ —         1234          -
       D
       <
 D
        8
        9
       17
*      31
*      36
*      37
   99999
   999999
```

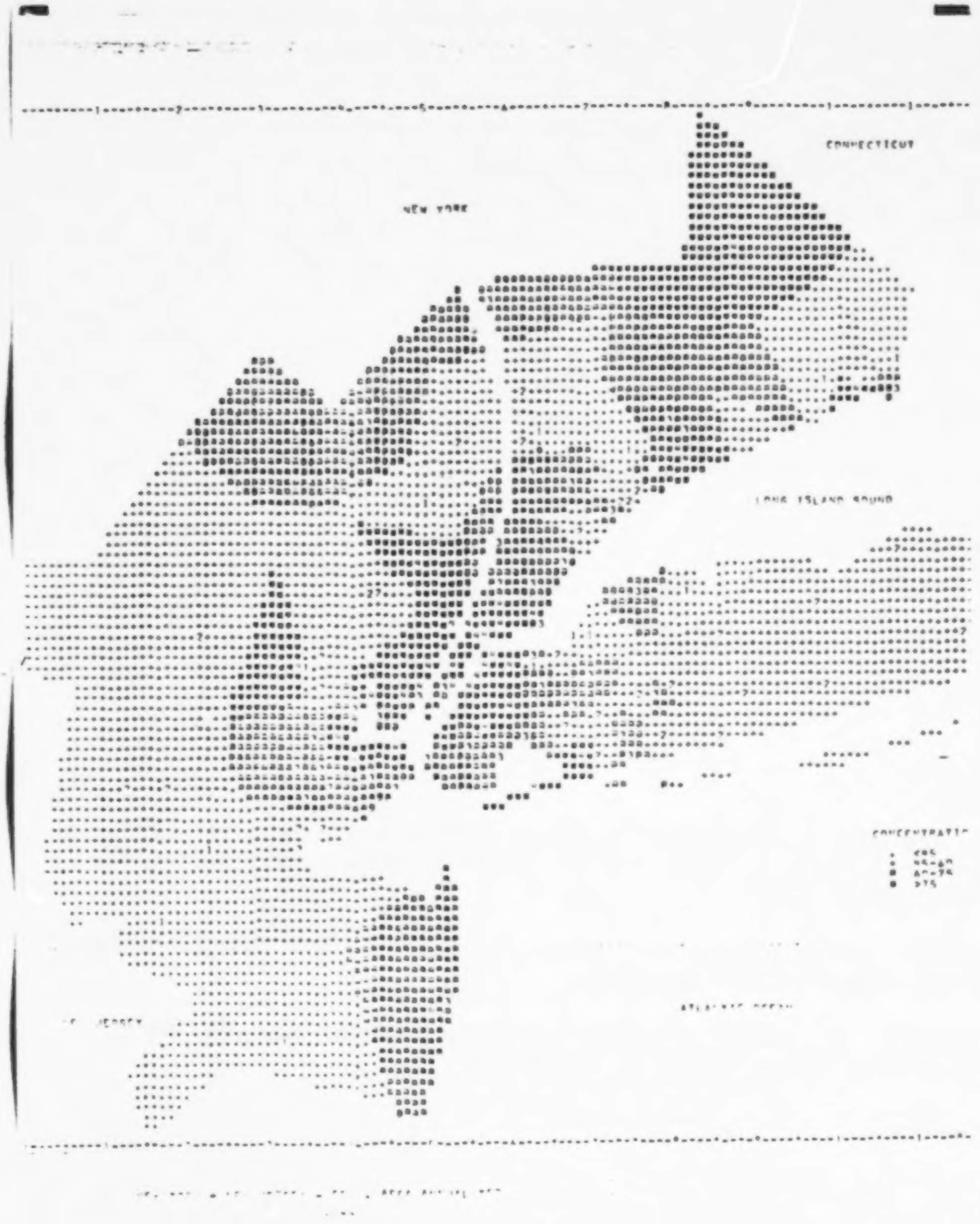
6. Essentially the same package used as for a contour map. Because actual instead of interpolated data values are used, proximal maps give some detail which contour maps do not show.

*1234567890...are column numbers placed in the list for your convenience. Do not put these in your program.

*Electives 31, 36, and 37 are required for a proximal map, but no specifications for each one are necessary.

bBlank card

Map 6. Proximal


CONNECTICUT
NEW YORK
LONG ISLAND SOUND
CONCENTRATIO
<55
55-60
60-75
>75
ATLANTIC OCEAN
NEW JERSEY

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4.2-E Data Listings for SYMAP Examples

```
TRAP.SYMAP-DATA.NY-BDRY
     1          A     40.0      38.5
     2                52.0      27.5
     3                62.4      43.4
     4                71.0      45.3
     5                79.0      54.5
     6                78.5      56.0
     7                63.7      53.2
     8                62.3      48.0
     9                59.8      45.1
    10                47.4      48.8
    11                40.0      38.5
    12          A     52.0      27.5
    13                69.6      13.8
    14                70.0       4.0
    15                85.1       4.0
    16                87.6      11.6
    17                84.0      23.0
    18                95.0      26.8
    19                85.2      38.7
    20                70.0      40.3
    21                71.0      45.3
    22                62.4      43.4
    23                52.0      27.5
    24          A     95.0      26.8
    25                84.0      23.0
    26                87.6      11.6
    27               113.0       6.6
    28               121.3      10.8
    29               119.4      20.8
    30               109.0      30.0
    31               101.7      25.0
    32                99.9      31.0
    33                93.9      34.0
    34                92.2      30.4
    35                95.0      26.8
    36          A     99.9      31.0
    37               101.7      25.0
    38               109.0      30.0
    39               119.4      20.8
    40               120.0      18.0
    41               126.3      17.7
    42               130.9      28.0
    43               134.8      28.0
    44               134.4      30.2
    45               119.6      45.0
    46               114.2      45.6
    47               110.5      43.1
    48               107.0      46.3
    49               100.0      49.1
    50                99.9      31.0
    51          A    114.2      45.6
    52               119.6      45.0
    53               134.4      30.2
    54               135.2      26.0
    55               142.2      18.6
    56               151.5      21.6

        col          11-20     21-30
```

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Note that for each area, A, the first and last vertices are the same.

57		141.3	33.0
58		144.0	44.9
59		146.8	56.9
60		149.5	56.9
61		149.5	61.0
62		129.5	66.0
63		117.0	66.0
64		112.0	64.0
65		118.4	62.7
66		114.8	55.5
67		114.2	45.6
68	A	100.0	49.1
69		107.0	46.3
70		110.0	46.7
71		110.0	49.0
72		100.5	60.5
73		95.0	59.0
74		96.2	50.2
75		97.2	49.4
76		100.0	49.1
77	A	85.2	38.7
78		92.2	30.4
79		93.9	34.0
80		99.9	31.0
81		100.0	49.1
82		97.2	49.4
83		96.2	50.2
84		91.7	52.6
85		85.2	38.7
86	A	70.0	40.3
87		85.2	38.7
88		91.7	52.6
89		79.0	54.5
90		71.0	45.3
91		70.0	40.3
92	A	83.3	54.0
93		87.2	53.4
94		87.5	55.0
95		94.0	55.0
96		94.0	58.0
97		81.0	65.3
98		78.9	63.5
99		85.0	58.0
100		83.3	54.0
101	A	47.4	48.8
102		59.8	45.1
103		62.3	48.0
104		63.7	53.2
105		78.5	56.0
106		79.0	54.5
107		83.3	54.0
108		85.0	58.0
109		78.9	63.5
110		81.0	65.3
111		62.3	72.8
112		47.4	48.8
113	A	47.4	48.8

114		62.3	72.8
115		46.8	72.8
116		30.0	67.0
117		47.4	48.8
118	A	29.8	68.5
119		36.2	72.4
120		50.7	74.5
121		61.4	74.2
122		69.7	72.0
123		74.0	80.0
124		62.0	92.0
125		52.4	85.5
126		40.5	103.5
127		34.0	99.0
128		26.6	99.0
129		29.8	68.5
130	A	69.7	72.0
131		81.0	70.0
132		79.5	79.0
133		74.0	80.0
134		69.7	72.0
135	A	81.7	66.3
136		89.5	62.0
137		92.0	61.8
138		92.0	63.0
139		81.0	70.0
140		69.7	72.0
141		81.7	66.3
142	A	99.0	61.0
143		103.0	64.0
144		102.0	72.2
145		98.2	72.3
146		95.9	75.3
147		87.0	68.0
148		92.8	64.0
149		99.0	61.0
150	A	87.0	68.0
151		95.9	75.3
152		98.7	81.0
153		97.0	84.0
154		89.0	84.0
155		87.8	86.4
156		83.0	82.0
157		83.0	70.1
158		87.0	68.0
159	A	83.0	82.0
160		87.8	86.4
161		89.0	84.0
162		97.0	84.0
163		98.7	81.0
164		100.0	83.0
165		105.6	67.5
166		106.5	68.0
167		99.7	88.5
168		95.9	106.0
169		84.0	106.0
170		73.9	103.0

171		70.0	99.0
172		75.2	85.5
173		83.0	82.0
174	A	73.9	103.0
175		84.0	106.0
176		95.9	106.0
177		82.5	155.0
178		67.1	155.0
179		65.5	130.5
180		72.0	120.0
181		69.0	116.0
182		69.0	103.0
183		73.9	103.0
184	A	26.6	99.0
185		34.0	99.0
186		40.5	103.5
187		52.4	85.5
188		62.0	92.0
189		46.0	126.0
190		48.0	129.0
191		31.0	132.0
192		4.8	101.0
193		26.6	99.0
194	A	100.9	91.0
195		102.0	91.2
196		103.5	86.0
197		103.0	84.9
198		100.9	91.0
199	A	99.0	107.1
200		100.0	107.9
201		103.0	95.0
202		102.0	95.0
203		93.0	107.1
204	A	97.0	126.0
205		99.0	125.7
206		99.5	115.0
207		98.0	115.0
208		97.0	126.0
209	A	93.0	137.8
210		94.0	138.0
211		97.3	128.7
212		96.3	128.0
213		93.0	137.8

```
TRKP*SYMAP-DATA.NY-720-B
    1                  43.5      124.0
    2                  43.5      124.0
    3                  45.5      123.5
    4                  24.5      106.0
    5                  43.5      118.5
    6                  59.5       92.0
    7                  56.5       94.5
    8                  61.0       91.0
    9                  54.5       91.5
   10                  57.5       94.5
   11                  49.0      108.5
   12                  48.0      109.0
   13                  55.5       99.5
   14                  54.0       98.5
   15                  51.0       99.5
   16                  50.0       96.5
   17                  41.0      129.0
   18                  94.5       49.5
   19                  88.5       60.5
   20                  90.0       52.0
   21                 132.0       64.0
   22                 101.5       24.5
   23                 101.5       48.5
   24                  85.0       43.0
   25                  85.0       45.0
   26                  79.0       65.0
   27                  86.0       68.5
   28                  88.0       47.5
   29                  87.0       60.5
   30                  88.5       58.5
   31                  98.5       47.0
   32                 121.0       23.5
   33                 139.0       41.5
   34                  80.5       29.5
   35                  88.5       53.5
   36                 110.5       31.0
   37                  83.5       47.5
   38                  75.0       55.5
   39                  75.0       54.0
   40                 108.0       44.0
   41                  99.0       44.0
   42                  94.5       45.5
   43                 102.5       19.5
   44                 110.5       43.0
   45                  84.5       61.5
   46                  62.0       62.5
   47                  80.0       70.5
   48                  88.5      107.0
   49                  95.0       95.5
   50                  89.0       92.0
   51                  74.0       92.0
   52                  97.5       91.0
   53                  92.5       86.5
   54                  97.0       87.0
   55                  89.0       95.0
   56                  97.5       84.0
```

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```
         ↑        ↑
col    11-20    21-30
         Y        X
```

57	80.0	83.5
58	66.0	84.5
59	87.5	96.5
60	94.5	103.5
61	75.0	99.5
62	81.0	104.0
63	69.5	81.5
64	84.5	68.0
65	84.5	68.0
66	53.0	76.0
67	45.5	75.5
68	33.0	71.5
69	61.0	89.5
70	53.0	67.0
71	95.0	90.5
72	62.5	88.5
73	71.0	160.0
74	49.5	54.5
75	69.0	129.5
76	81.0	139.0
77	87.0	119.0
78	76.5	118.0
79	51.5	78.5
80	84.5	77.5
81	81.0	85.0
82	56.5	77.5
83	59.0	82.5
84	67.0	73.0
85	78.5	68.0
86	76.0	72.0
87	87.0	78.0
88	85.0	65.5
89	73.0	72.5
90	82.5	77.0
91	79.5	78.5
92	94.5	64.0
93	87.5	68.0
94	81.0	69.0
95	83.5	80.5
96	86.5	85.5
97	87.0	66.0
98	93.0	70.5
99	90.5	73.5
100	79.0	73.0
101	96.0	68.0
102	95.5	76.5
103	94.0	82.0
104	97.5	51.5
105	96.5	58.0
106	100.5	54.5
107	102.0	57.5
108	108.5	46.5
109	88.0	64.0
110	77.0	77.0
111	73.0	77.0
112	83.0	71.5
113	84.5	74.0
114	84.5	70.5
115	90.5	83.0
116	97.0	62.5
117	97.5	72.5
118	102.5	77.0
119	70.0	61.0
120	92.0	56.0
121	103.0	45.0
122	45.0	129.0

```
TRRP.SYMAP-DATA.NY-72G-E
     1                        51.0
     2                        56.1
     3                        91.7
     4                        84.1
     5                        43.4
     6                        56.9
     7                        60.6
     8                        56.4
     9                        38.6
    10                        70.4
    11                        54.3
    12                        63.0
    13                       127.1
    14                       112.5
    15                        74.1
    16                        68.3
    17                        44.5
    18                        79.0
    19                        72.0
    20                        66.0
    21                        68.0
    22                        54.0
    23                        63.0
    24                       114.0
    25                        34.0
    26                        81.0
    27                       113.0
    28                        48.0
    29                        83.0
    30                        75.0
    31                        70.0
    32                        41.0
    33                        35.0
    34                        47.0
    35                       134.0
    36                        37.0
    37                        57.0
    38                        56.0
    39                        56.0
    40                        58.0
    41                        66.0
    42                        66.0
    43                        47.0
    44                        56.0
    45                        80.0
    46                        42.0
    47                        95.0
    48                        52.0
    49                        54.0
    50                        52.0
    51                        68.0
    52                        73.0
    53                        58.0
    54                        57.0
    55                        60.0
    56                        80.0
```

↑

col 11-20

```
    57                 43.0
    58                 57.0
    59                 49.0
    60                 58.0
    61                 43.0
    62                 45.0
    63                 64.0
    64                 76.0
    65                 83.0
    66                 47.0
    67                 49.0
    68                 74.0
    69                 53.0
    70                 54.0
    71                 73.0
    72                 64.0
    73                 34.0
    74                 60.0
    75                 57.0
    76                 47.0
    77                 47.0
    78                 47.0
    79                 41.0
    80                 30.0
    81                 43.0
    82                 67.0
    83                 64.0
    84                 72.0
    85                 79.0
    86                 98.0
    87                 60.0
    88                 83.0
    89                 73.0
    90                 67.0
    91                 68.0
    92                 87.0
    93                102.0
    94                 94.0
    95                 57.0
    96                 67.0
    97                 87.0
    98                 82.0
    99                 79.0
   100                 90.0
   101                 73.0
   102                 64.0
   103                 58.0
   104                 78.0
   105                 84.0
   106                 60.0
   107                 71.0
   108                 59.0
   109                 73.0
   110                 94.0
   111                 72.0
   112                 78.0
   113                 76.0




   114                 90.0
   115                 65.0
   116                 70.0
   117                 67.0
   118                 81.0
   119                131.0
   120                 66.0
   121                 60.0
   122                 60.3
```

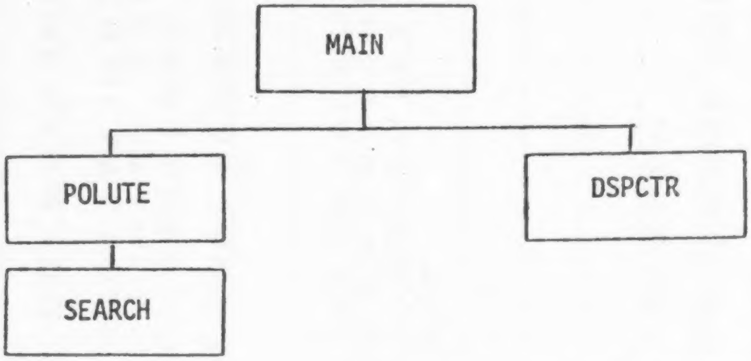
4.3 TRICON

TRICON is not available on the UNIVAC at this time. The use of TRICON will be documented in an update to this manual.

5.0 PROGRAM LISTINGS

Long-Term Population Exposure Model (LPEM)

Subroutine Hierarchy



MAIN: Reads program control parameters and input data.
Calls subroutine POLUTE and DSPCTR

POLUTE: Computes a spatially interpolated annual mean concentration at each receptor point.
Calls subroutine SEARCH.

DSPCTR: Computes a distribution of area and that of the population exposed to various levels of annual mean concentration.
Computes a spatial average concentration and a population weighted average concentration.

SEARCH: Finds the three monitoring stations nearest to each receptor point.

```
      COMMON   AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMG(200),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPOPL
     2,CFRQ(300,8),F(300,4),NOBS,CPOLU(300),XLOW,XINCR,NINCR
      DIMENSION  AREA(300),POPCNT(300,4),IRECEP(300,2),IRSA(300),POPL(30
     35,2),IOBS(9),ISITE(200,2)
      DIMENSION  IDRSA(300,2)
      DIMENSION  STAAVG(10),KVALID(10),YY(10)
C
C -- STORAGE FOR MEAN CONCENTRATIONS FOR ALL YEARS
      DIMENSION  CM(200,10)
      DIMENSION  TITLE(13)
      COMMON MNODE(100),X(10,100),Y(10,100),P(10,100),MOUNTN,NPOIST
C
      DATA IOBS/8760,6257,2503,2868,5892,3389,365,261,104/
      EPS = 1.E-10
C
C
C
C                     EXPLANATION OF PARAMETERS
C     AWSTD = AIR QUALITY STANDARD (ANY UNIT)
C     NRECEP = NO. OF RECEPTOR POINTS  (GE.1)
C     NHOUR = SAMPLING INTERVAL IN HOURS (1 OR 24)
C     NSITES  = NO. OF AIR MONITORING STATIONS (GE.3) WITH DATA
C     NMONT  =  NO. OF AIR MONITORING STATIONS WITH COORDINATES(GE.NMONT)
C     NYEAR  = NO. OF YEARS TO ANALIZE (EACH YEAR MUST HAVE BOTH POPLATI
C                 ON AND AIR QUALITY DATA) (GE.1)
C     SYEAR  = INITIAL YEAR
C     DELYR  = INCREMENTAL YEAR
C     NTIME  = NO. OF TIME CATEGORIES SUCH AS WEEKDAY AND WEEKEND (1 TO
C                 6)
C     NRSA   = NO. OF REGIONAL STATISTICAL AREAS IN WHICH CURRENT OR PRO
C                 -JECTED POPULATION STATISTICS ARE AVAILABLE (GE.1)
C     NPOPL  = NO. OF POPULATION CLASS SUCH AS SCHOOL-AGE AND ELDERLY (
C                 1 TO 7)
C     NOBS      = NO. OF POSSIBLE OBSERVATIONS, E.G., 8760 FOR ANNUAL HOUR
C     -LY CONCENTRATION PERCENTILI STATISTICS
C      XLOW = LOWEST CONCENTRATION VALUE FOR DISTRIBUTIONS
C     XINCR = INCREMENTAL VALUE FOR DISTRIBUTIONS
C     NINCR = NO. OF INCREMENTS FOR DISTRIBUTIONS
```

```
      C
      C                        EXPLANATION OF INPUT DATA
      C
      C
      C       AREA(I) = AREA OF EACH RSA IN SQ. MI.
      C       POPCNT(I,J) =  SUBPOPLATION PER CENT OF TOTAL POPULATION AT EACH
      C                      RSA IN 1970 OR OTHER CENCUS YEAR
      C       IRECEP(I,J) = RECEPTOR IDENTIFICATION NUMBER
      C       RECEP (I,J) = X-Y COORDINATE OF EACH RECEPTOR
      C       IRSA (I,J) = NO. OF RECEPTOR POINTS ASSIGNED TO A GIVEN RSA
      C       ISITE(I)    = AIR MONITORING STATION I.D. NUMBER
      C       SITE (I,J) = X-Y COORDINATE OF EACH STATION
      C       POPL (I,J) =  TOTAL POPULATION AND TOTAL EMPLOYMENT AT EACH RSA
      C                        IN EACH YEAR
      C
      C
      C -- WHEN PENALTY DISTANCE IS USED (NPDIST=1) THE FOLLOWING
      C       ARE REQUIRED -
      C       MOUNTN = NO. OF GEOGRAPHICAL BARRIERS TO BE INCLUDED IN
      C       SPATIAL INTERPOLATION
      C       MNODE(I) = NO. OF NODES USED TO APPROXIMATE LOCATION OF EACH
      C                GEOGRAPHICAL BARRIER
      C       X(I,J) AND Y(I,J) = X AND Y COORDINATES OF J-TH NODE OF I-TH
      C              MOUNTAIN
      C       P(I,J) = PENALTY DISTANCE ASSIGNED TO THE J-TH NODE OF I-TH
      C             MOUNTAIN.
      C
      C
      C
            NT=0
      C************************************************************************
            READ(5,216)(TITLE(I),I=1,13)
        216 FORMAT(13A6)
        100 FORMAT(1H1,25X,13A6////)
            READ(5,210)NRECEP,NMONT,NSITES,NRSA,NTIME,NPOPL,NHOUR,NYEAR,SYEAR,
           3DELYR,AQSTD,NPDIST
        210 FORMAT(8I5,3F10.1,I5)
            READ(5,211)XLOW,XINCR,NINCR
        211 FORMAT(2F10.0,I5)
        200 FORMAT(5X,8HNRECEP =,I5,3X,6HNRSA =,I5,3X,7HNMONT =,I5,3X,7HNSITES
           1=,I5,3X,7HNPOPL =,I3,3X,/,5X,7HNYEAR =,I5,5X,
     2 7HSYEAR =,F8.1,5X,7HDELYR =,F5.1,5X,7HAQSTD =,F7.1/)
C
      IF(NPDIST.EQ.0)GO TO 1111
      READ(5,1001) MOUNTN,(MNODE(I),I=1,MOUNTN)
 1001 FORMAT(I2,20I3)
      DO 33 I=1,MOUNTN
      MND=MNODE(I)
      DO 32 J=1,MND
      READ(5,2001) X(I,J),Y(I,J),P(I,J)
 2001 FORMAT(3F8.2)
      P(I,J)=10. * P(I,J)
   32 CONTINUE
   33 CONTINUE
 1111 CONTINUE
      WRITE (6,100)(TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
      WRITE(6,215)
  215 FORMAT(2X,' CHARACTERISTICS OF STATISTICAL AREAS'/)
      DO 10 I=1,NRSA
C*********************************************************************
      READ(5,220)(IDRSA(I,J),J=1,2) , AREA(I),(POPCNT(I,J),J=1,4)
  220 FORMAT (2I10,10X,5F10.2)
   10 CONTINUE
C*********************************************************************
      DO 20 I = 1,NRECEP
      READ(5,230) (IRECEP(I,J),J=1,2),(RECEP(I,J),J=1,2)
  230 FORMAT(2I10,2F10.2)
   20 CONTINUE
C*********************************************************************
      READ(5,240) (IRSA(I),I=1,NRSA)
  240 FORMAT((16I5))
      DO 11 I=1,NRSA
      WRITE(6,225)I,(IDRSA(I,J),J=1,2),AREA(I),(POPCNT(I,J),J=1,4),IRSA(
     1I)
  225 FORMAT(2X,'NO.=',I3,3X,'SA=',2I5,5X,'AREA =',F6.2,5X,
     3'SUBPOP A,B,C,D (IN %) =',4F7.1,8X,'RECEPTORS PER SA =',I3
     1)
   11 CONTINUE
      DO 30 I = 1,NMONT
      READ(5,250) (ISITE(I,J),J=1,2),(SITE(I,J),J=1,2)
  250 FORMAT (2I10,2F10.2)
   30 CONTINUE
C
C -- READ MEAN CONCENTRATIONS FOR ALL YEARS
C*****************************************************************
      DO 34 I=1,NSITES
      READ(5,257)INSITE,KSITE,(CM(INSITE,J),J=1,NYEAR)
257   FORMAT(2I5,7F10.2)
34    CONTINUE
C
C     END TIME INDEPENDENT INPUT DATA AND START YEAR LOOP
C
      YEAR = SYEAR
      WRITE (6,100)(TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
      WRITE (6,265) YEAR
  265 FORMAT (20X,' POPULATION DATA - TOTAL POPULATION AND ALL WORKERS B
     3Y WORK PLACE (',F8.1,3H )//)
        DO 50 I=1,NRSA
C*****************************************************************
        READ (5,260) (IDRSA(I,J),J=1,2),  (POPL(I,J),J = 1,2)
  260   FORMAT(2I10,2F10.0)
        WRITE (6,275) I,(IDRSA(I,J),J=1,2),(POPL(I,J),J=1,2)
  275 FORMAT (1X,'NO.= ',I3,2X,'SA= ',2I6,10X,'TOTAL POP.= ',F10.0,10X,'ALL
     3  WKRS BY',' WK-PLACE= ',F10.0)
   50   CONTINUE
      WRITE(6,100) (TITLE(K),K=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
      WRITE(6,245)
C*****************************************************************
  245 FORMAT(30X,' AIR MONITORING STATIONS '//)
      DO 31 K=1,NMONT
      WRITE(6,255) K,(ISITE(K,J),J=1,2),(SITE(K,J),J=1,2)
  255 FORMAT (2X,4HNO.=,I4,5X,'STATION NO.=',2I5,10X,' X-Y COORDINATE = ',
     32F10.2)
  31  CONTINUE
        WRITE (6,100)(TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
        WRITE (6,285)
  285 FORMAT (30X,'RECEPTOR SPECIFICATION DATA'//)
        TAREA =0.
C******      WRITE NUMBER OF RECEPTORS ON FILE 9.    ********
      WRITE(9,101)NRECEP
        DO 60 I= 1,NRECEP
      KRSA = IRECEP(I,1)
        NN = IRSA(KRSA)
        IF (NN.LE.0) GO TO 60
   61   AWT(I) = AREA(KRSA)/NN
      RPOPL(I,1) = POPL(KRSA,1)/NN
      RPOPL(I,2) = POPL(KRSA,2)/NN
      TAREA = TAREA + AWT(I)
      WRITE(6,295)I,(IRECEP(I,J),J=1,2),(RECEP(I,J),J=1,2),(RPOPL(I,J),
     3  J=1,2),AWT(I)
  295 FORMAT(2X,4HNO =,I5,3X,'RECEPT NO. =',2I6,5X,'X-Y COORD =',2F7.2,
     3 5X,'TPOPL - WKRPL',2H =,2F8.0,5X,'AREA =',F8.2)/

C*********      WRITE POPULATION DENSITIES ON FILE 9.    **********
      IF(AWT(I).EQ.0)GO TO 59
      D=RPOPL(I,1)/AWT(I)
      WRITE(9,102) D,(RECEP(I,J),J=1,2),IYEAR
   59 CONTINUE
   60   CONTINUE
      WRITE(6,100) (TITLE(I),I=1,13)
C
      DO 79 J=1,NYEAR
      YY(J )=SYEAR+(J-1 )*DELYR
      STAAVG(J)=0.
      KVALID(J)=0
   79 CONTINUE
      WRITE(6,314) (YY(J),J=1,NYEAR )
  314 FORMAT(//54X,'AIR QUALITY MONITORING DATA',//,44X,'YEAR :',/,34X,
     1 7F10.0/)
      DO 80 I=1,NMONT
      K=0
      DO 81 NY =1,NYEAR
      IF(CM(I,NY).EQ.0.)GO TO 81
      K=1
      STAAVG(NY)=STAAVG(NY)+CM(I,NY)
      KVALID(NY)=KVALID(NY)+1
   81 CONTINUE
      IF(K.EQ.1)WRITE(6,315)I,(ISITE(I,J),J=1,2),
     1      (CM(I,NY),NY=1,NYEAR)
   80 CONTINUE
      DO 82 NY=1,NYEAR
      STAAVG(NY)=STAAVG(NY)/KVALID(NY)
   82 CONTINUE
  315 FORMAT(2X,I3,3X,'ST. ID.NO. =',2I5,5X,7F10.1)
      WRITE(6,313)(STAAVG(NY),NY=1,NYEAR)
  313 FORMAT(5(/),7X,'STATION AVERAGE =',10X,7F10.2)
      DO 40 NY=1,NYEAR
C  **PUT SITE STATISTICS ON FILE 7  **
      WRITE(7,101)KVALID(NY)
  101 FORMAT(I3)
      DO 41 I=1,NMONT
      CMG(I)=CM(I,NY)
      IF(CMG(I).GT.0.)WRITE(7,102)CMG(I),(SITE(I,J),J=1,2),I,YEAR
  102 FORMAT(3F10.2,I10,F10.1)
   41 CONTINUE
C        START COMPUTING PERCENTILE CONCENTRATION AT EACH RECEPTOR BY
C        USING AN INTERPOLATION FORMULA
C
         WRITE(6,100)(TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
      WRITE(6,325)YEAR
  325   FORMAT (20X,'INTERPOLATED - EXTERPOLATED CONCEN',
     3   'RATIONS AT RECEPTOR SITES',5X,6HYEAR =,F7.1)
      CALL POLUTE
C
C
C        START POPULATION CLASS LOOP
C
C        POPULATION CLASS =1  FOR TOTAL POPULATION
C        POPULATION CLASS = 2 FOR SCHOOL AGE POPULATION
C        POPULATION CLASS = 3  FOR ELDERLY POPULATION
C        POPULATION CLASS = 4  FOR NON-WHITE POPULATION
```

```
C          POPULATION CLASS = 5  ALL WORKERS BY RESIDENCE
C          POPULATION CLASS = 6  ALL NON-WORKERS BY RESIDENCE
C          POPULATION CLASS = 7  ALL WORKERS BY WORK PLACE
C
89       M=MIND(7,NPOPL)
           DO 90  NP = 1,M
           TPOPL = 0.
             DO 95 I = 1,NRECEP
             K = IRECEP(I,1)
             TOTALP = RPOPL(I,1)
             GO TO (91,92,93,94,97,98,99),NP
  91         DENSTY (I) = TOTALP
             GO TO 96
  92         DENSTY (I) = TOTALP * POPCNT(K,1)/100.
             GO TO 96
  93         DENSTY (I) = TOTALP * POPCNT(K,2)/100.
             GO TO 96
  94         DENSTY (I) = TOTALP *POPCNT(K,3)/100.
             GO TO 96
  97         DENSTY(I)=TOTALP*POPCNT(K,4)/100.
             GO TO 96
  98         DENSTY(I)=TOTALP*(100.-POPCNT(K,4))/100.
             GO TO 96
  99         DENSTY(I)=RPOPL(I,2)
  96         TPOPL = TPOPL + DENSTY(I)
  95         CONTINUE
           WRITE (6,100)(TITLE(I),I=1,13)
        WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
       + AQSTD
           WRITE (6,345) YEAR,NP,TPOPL,TAREA
 345       FORMAT(20X,'EXPOSURE DISTRIBUTIONS FOR    ',6HYEAR =,F8.1,3X,
     3     9HPOPL CL =,I2,3X,8HTPOPL =,F10.0,5X,4HTARE,
     3     3HA =,F10.0//)
           CALL DSPCTR
  90       CONTINUE
        YEAR = YEAR + DELYR
  40    CONTINUE
        WRITE(6,100)(TITLE(I),I=1,13)
        STOP
        SUBROUTINE POLUTE
```

```
      COMMON   AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMG(200),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPOPL
     2,CFRQ(300,8),F(300,4),NOBS,CPOLU(300),XLOW,XINCR,NINCR
      DIMENSION S(2),R(2)                                                FO      13
      DIMENSION SS(2),CORD(2),CORD1(2),XS(200),YS(200),XN(10,100),YN(10, FO      14
     1 100)                                                              FO      14
      COMMON MNODE(100),X(10,100),Y(10,100),P(10,100),MOUNTN,NPDIST      FO      15
      DIMENSION XX(10,100),YY(10,100)                                    FO      17
      DIMENSION XM(300),YM(300)
      MVALID=0
      DO 10 I=1,NMONT
      XM(I)=SITE(I,1)
      YM(I)=SITE(I,2)
   10 CONTINUE
C*******   WRITE NUMBER RECEPTORS ON FILE 8.    ***************
      WRITE(8,101)NRECEP
  101 FORMAT(I3)
      DO 20 N=1,NRECEP
      XR=RECEP(N,1)
      YR=RECEP(N,2)
      R(1)=XR                                                            FO      26
      R(2)=YR                                                            FO      27
      IF(NPDIST.EQ.0)GO TO 1111                                          FO      28
C     DO(I=1,MOUNTN)                                                     IF      29
      DO 19999 I=1,MOUNTN                                                        29
        MND=MNODE(I)                                                     FO 1    30
C       DO(J=1,MND)                                                      IF 1    31
        DO 19998 J=1,MND                                                         31
          CORD(1)=X(I,J)                                                 FO 2    32
          CORD(2)=Y(I,J)                                                 FO 2    33
          CALL TRNSLT(CORD,R,CORD1)                                      FO 2    34
          XX(I,J)=CORD1(1)                                               FO 2    35
          YY(I,J)=CORD1(2)                                               FO 2    36
C       END DO                                                           IF 1    37
19998   CONTINUE                                                                 37
C     END DO                                                             IF      38
19999 CONTINUE                                                                   38
 1111 CONTINUE                                                           FO      39
      DO 30 I=1,NMONT
      CHECK=CMG(I)
```

```
            IF(CHECK) 51,51,52
         51 DIST=9.9E10
            GO TO 53
         52 XDIST=XM(I)-XR
            YDIST=YM(I)-YR
            DIST=SQRT(XDIST*XDIST+YDIST*YDIST)
      C INSERT 6
            IF(NPDIST.EQ.0)GO TO 1112                                          FO     48
            S(1)=XM(I)                                                         FO     49
            S(2)=YM(I)                                                         FO     50
            CALL TRNSLT(S,R,SS)                                                FO     51
      C AFTER ROTATION THE STATION POINT IS ON THE X DOUBLE PRIME AXIS         FO     52
            XS(I)=DIST                                                         FO     53
            YS(I)=0.0                                                          FO     54
      C FIND THE COORDINATE OF EACH MOUNTAIN NODE IN THE DOUBLE PRIMED SYSTEM FO     55
            THETA=ATAN2(SS(2),SS(1))                                           FO     56
      C     DO(J=1,MOUNTN)                                                     IF     57
            DO 19997 J=1,MOUNTN                                                       57
              MND=MNODE(J)                                                     FO 1   58
      C       DO(K=1,MND)                                                      IF 1   59
              DO 19996 K=1,MND                                                        59
                XN(J,K)=XX(J,K)*COS(THETA)+YY(J,K)*SIN(THETA)                  FO 2   60
                YN(J,K)=-XX(J,K)*SIN(THETA)+YY(J,K)*COS(THETA)                 FO 2   61
      C       END DO                                                           IF 1   62
      19996   CONTINUE                                                                62
      C     END DO                                                             IF     63
      19997 CONTINUE                                                                  63
      C TEST WHETHER EACH MOUNTAIN NODE IS ON THE X DOUBLE PRIME AXIS AND BETWFO     64
      C STATION AND RECEPTOR POINTS                                            FO     65
      C     DO(J=1,MOUNTN)                                                     IF     66
            DO 19995 J=1,MOUNTN                                                       66
              MND=MNODE(J)                                                     FO 1   67
      C       DO(K=1,MND)                                                      IF 1   68
              DO 19994 K=1,MND                                                        68
      C         IF(YN(J,K).EQ.0.0.AND.XN(J,K).LE.DIST.AND.XN(J,K).GT.0.0)      IF 2   69
                IF(                                                                   69
           *    YN(J,K).EQ.0.0.AND.XN(J,K).LE.DIST.AND.XN(J,K).GT.0.0                 69
           *    ) GO TO 19991                                                         69
                GO TO 19992                                                           69
      19991     CONTINUE                                                              69
```

```
                DIST=DIST+P(J,K)
         C      END IF                                                FO 3   70
         19992  CONTINUE                                              IF 2   71
         19993  CONTINUE                                                     71
         C     END DO                                                        71
         19994 CONTINUE                                               IF 1   72
         C    END DO                                                         72
         19995 CONTINUE                                               IF     73
         C TEST WHETHER THE STATION-RECEPTOR LINE CROSS ANY MOUNTAIN REGION   73
         C    DO(J=1,MOUNTN)                                          FO     74
              DO 19990 J=1,MOUNTN                                     IF     75
                M1=MNODE(J)-1                                                75
         C      DO(K=1,M1)                                            FO 1   76
                DO 19989 K=1,M1                                       IF 1   77
         C        IF(XN(J,K).EQ.XN(J,K+1))                                   77
                  IF(XN(J,K).EQ.XN(J,K+1)) GO TO 19986                IF 2   78
                  GO TO 19987                                                78
         19986    CONTINUE                                                   78
         C          IF(XN(J,K).LE.XS(I))                                     78
                    IF(XN(J,K).LE.XS(I)) GO TO 19983                  IF 3   79
                    GO TO 19984                                              79
         19983      CONTINUE                                                 79
         C            IF(YN(J,K)*YN(J,K+1).LT.0.0)                           79
                      IF(YN(J,K)*YN(J,K+1).LT.0.0) GO TO 19980        IF 4   80
                      GO TO 19981                                            80
         19980        CONTINUE                                               80
                        PENL=P(J,K)+(P(J,K+1)-P(J,K))*ABS(YN(J,K))/ABS(YN(J,K)) FO 5   81
                **ABS(YN(J,
                1               K+1)))                                       81
                        DIST=DIST+PENL                                FO     81
         C            END IF                                          FO 5   82
         19981        CONTINUE                                        IF 4   83
         19982        CONTINUE                                               83
         C          END IF                                                   83
         19984      CONTINUE                                          IF 3   84
         19985      CONTINUE                                                 84
         C        ELSE                                                       84
                  GO TO 19988                                         IF 2   85
         19987    CONTINUE                                                   85
         C          IF(YN(J,K)*YN(J,K+1).LT.0.0)                             85
                                                                      IF 3   86
                  IF(YN(J,K)*YN(J,K+1).LT.0.0) GO TO 19977                                      86
                  GO TO 19978                                                                   86
      19977       CONTINUE                                                                      86
                    SLOPE=(YN(J,K)-YN(J,K+1))/(XN(J,K)-XN(J,K+1))                    FO 4      87
      C             IF (SLOPE.NE.0.0)                                                 IF 4      88
                    IF (SLOPE.NE.0.0) GO TO 19974                                               88
                    GO TO 19975                                                                 88
      19974         CONTINUE                                                                    88
                      XINTCP=XN(J,K)-YN(J,K)/SLOPE                                    FO 5      89
      C               IF (XINTCP.LE.XS(I).AND.XINTCP.GT.0.0)                          IF 5      90
                      IF (XINTCP.LE.XS(I).AND.XINTCP.GT.0.0) GO TO 19971                        90
                      GO TO 19972                                                               90
      19971           CONTINUE                                                                  90
                        PENL=P(J,K)+(P(J,K+1)-P(J,K))*ABS(YN(J,K))/(ABS(YN(J,K FO 6         91
           *)) +ABS(YN(J,                                                                       91
           1                 K+1)))                                                   FO        91
                        DIST=DIST+PENL                                                FO 6      92
      C               END IF                                                          IF 5      93
      19972           CONTINUE                                                                  93
      19973           CONTINUE                                                                  93
      C             END IF                                                            IF 4      94
      19975         CONTINUE                                                                    94
      19976         CONTINUE                                                                    94
      C           END IF                                                              IF 3      95
      19978       CONTINUE                                                                      95
      19979       CONTINUE                                                                      95
      C         END IF                                                                IF 2      96
      19988     CONTINUE                                                                        96
      C       END DO                                                                  IF 1      97
      19989   CONTINUE                                                                          97
      C     END DO                                                                    IF        98
      19990 CONTINUE                                                                            98
      1112  CONTINUE                                                                  FO        99
            IF (N.NE.1) GO TO 53
            MVALID=MVALID+1
         53 RANK(I)=DIST
            NSITE(I)=I
         30 CONTINUE
            IF(N.NE.1) GO TO 99
            WRITE(6,190) MVALID
```

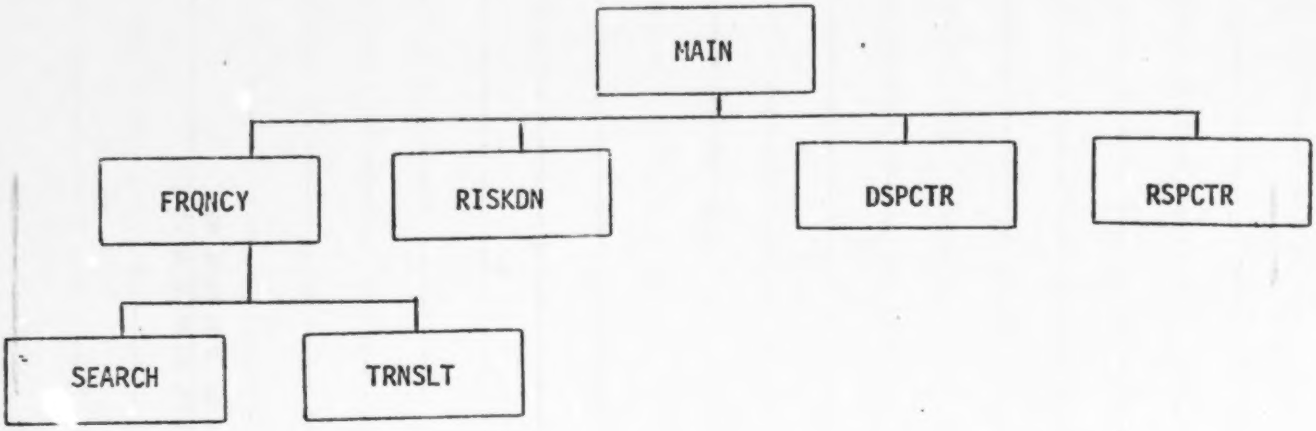
```
  190 FORMAT(5X,'NO. OF VALID MONITORING STATIONS=',I4/)
   99 CALL SEARCH
      TD=0.
      TC=0.
      DO 50 K=1,3
      M=NSITE(K)
      D=RANK(K)
      IF(D.LT.EPS) GO TO 55
      FWT=1./D**2
      TD=TD+FWT
      TC=TC+FWT*CMG(M)
   50 CONTINUE
      CPOLU(N)=TC/TD
      GO TO 40
 55   CPOLU(N)=CMG(M)
   40 CONTINUE
      WRITE(6,110) (IRECEP(N,J),J=1,2),CPOLU(N)
C********   PUT RECEPTOR STATISTICS ON FILE 8.   ************
      WRITE(8,102) CPOLU(N),(RECEP(N,J),J=1,2),N,YEAR
  102 FORMAT(3F10.2,I10,F10.1)
 110  FORMAT(2X,'RECEPT NO. =',2I5,1X,F10.1)
   20 CONTINUE
      RETURN
C
      SUBROUTINE TRNSLT(CORD1,ORIGIN,CORD2)
      DIMENSION CORD1(2),ORIGIN(2),CORD2(2)
      DO 100 I=1,2
      CORD2(I)=CORD1(I)-ORIGIN(I)
 100  CONTINUE
      RETURN
      SUBROUTINE SEARCH
      COMMON  AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMG(200),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPOPL
     2,CFRQ(300,8),F(300,4),NOBS,CPOLU(300),XLOW,XINCR,NINCR
      M=NMONT-1
      DO 100 I=1,M
      K=I+1
      DO 100 J=K,NMONT
      IF(RANK(I)-RANK(J)) 100,100,10
C     SORT THE DISTANCES TO MONITORING STATIONS IN ASCENDING ORDER
```

```
   10 ADJUST=RANK(I)
      RANK(I)=RANK(J)
      RANK(J)=ADJUST
C     ORDER THE MONITORING STATION NUMBERS ACCORDINGLY
      IAJUST=NSITE(I)
      NSITE(I)=NSITE(J)
      NSITE(J)=IAJUST
  100 CONTINUE
      RETURN
      SUBROUTINE DSPCTR
      COMMON / LUPLCM / LUPLT
      COMMON  AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMG(200),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPOPL
     2,CFRQ(300,8),F(300,4),NOBS,CPOLU(300),XLOW,XINCR,NINCR
      DIMENSION DTHR(40)
      DO 25 I=1,NINCR
      DTHR(I)=XLOW+XINCR*(NINCR-I)
   25 CONTINUE
      WRITE(6,215)
  215 FORMAT(25X,'POPULATION AND LAND AREA EXPOSURE DISTRIBUTIONS'/)
      WRITE(6,214)
  214 FORMAT (33X,'DISTRIBUTION FUNCTIONS',23X,'FREQUENCY FUNCTIONS')
C      AWT(I)  =   AREA OF RECEPTOR I
C      DENSTY(I) = POPULATION OF RECEPTOR (I)
      AQS =0.
      PQS =0.
      PSAR =0.
      PSPP = 0.
      AREAVG = 0.
      POPAVG = 0.
   10 CONTINUE
      PTHR = DTHR(I)+XINCR
      WRITE(6,219)
  219 FORMAT(11X,'AIR QUALITY VALUE',8X,'AREA',11X,'POPULATION',
     117X,'AREA',12X,'POPULATION')
C     END INITIALIZATION AND START D. LOOP
      DO 20 J =1,NINCR
        DA =0.
        DP =0.
C     END INITIALIZATION AND START RECEPTOR LOOP
```

```
C
       DO 40 I=1,NRECEP
   34 CHEK=CPOLU(I)-DTHR(J)
        IF (CHEK) 41,42,42
    41  SIGN = 0.
        GO TO 43
    42  SIGN = 1.
    43  DA = DA + SIGN * AWT(I)
        DP = DP + SIGN * DENSTY(I)
    40 CONTINUE
       DELC = PTHR - DTHR(J)
      DSAR = DA/TAREA
       DSPP = DP/TPOPL
       ASPC = DSAR - PSAR
       PSPC = DSPP - PSPP
       AQS = AQS + 0.5*(DSAR+PSAR)*DELC
       PQS = PQS + 0.5*(DSPP+PSPP)*DELC
       PSAR = DSAR
       PSPP = DSPP
       PTHR = DTHR(J)
      WRITE(6,220)DTHR(J),DSAR,DSPP,ASPC,PSPC
  220 FORMAT(1X,F20.1,4F20.4,/)
   20 CONTINUE
C
C     END RECEPTOR LOOP
C
      DO 30 I=1,NRECEP
      POPAVG=POPAVG + CPOLU(I)*DENSTY(I)
      AREAVG=AREAVG + CPOLU(I)*AWT(I)
   30 CONTINUE
      AQS = AQS+DTHR(NINCR)
      PQS = PQS+DTHR(NINCR)
      POPAVG = POPAVG/TPOPL
      AREAVG = AREAVG/TAREA
      WRITE(6,240)AREAVG
      WRITE(6,250)POPAVG
  240 FORMAT(/20X,'SPATIAL AVERAGE CONCENTRATION = ',F10.4)
  250 FORMAT(20X,'POPULATION AVERAGE CONCENTRATION=',F10.4)
      RETURN
      END
```

Short-Term Population Exposure Model (SPEM)

Subroutine Hierarchy



MAIN:	Reads program control parameters and input data. Calls subroutines FRQNCY, RISKDN, DSPCTR, and RSPCTR.
FRQNCY:	Computer interpolated percentile concentrations at each receptor point. Calls subroutine SEARCH. Calls TRNSLT too when geographical barriers are used.
RISKDN:	Computes risk frequencies at each receptor point for concentration thresholds equal to 1, 2, 3, and 4 times the air quality standard.
DSPCTR:	Computes a distribution of area and that of the population exposed to various levels of percentile concentration at the 50th, 90th, and 99th percentiles. Computes both spatial average and population weighted average concentrations at the 50th, 90th, and 99th percentiles.
RSPCTR:	Computes a distribution of area and that of the population exposed above the air quality standard at various percentages of the time. Computes the spatial average and the population weighted average of risk frequencies.

(Continued)

SEARCH:	Finds the three monitoring stations nearest to each receptor point.
TRNSLT:	Translates the coordinate origin to a given receptor point.

IRRP.POPEXP.SPEM

```
      COMMON  AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMF(200,8),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPO
     2PL,CFRQ(300,8),F(300,4),NOBS, XLOW, XINCR, NINCR,PTILE(8)
      DIMENSION AREA(300), POPCNT(300,4),IRECEP(300,2),IRSA(300),POPL(21
     35,2),TITLE(13),IOBS(9),ISITE(200,2), IDRSA(300,2)
      COMMON MNODE(100),X(10,100),Y(10,100),P(10,100),MOUNTN,NPDIST
      DATA IOBS/8760,6257,2503,2868,5892,3389,365,261,104/
      EPS = 1.E-10
C
C
C
C                      EXPLANATION OF PARAMETERS
C     AQSTD = AIR QUALITY STANDARD (ANY UNIT)
C     NRECEP = NO. OF RECEPTOR POINTS  (GE.1)
C     NHOUR = SAMPLING IERVAL IN HOURS (1 OR 24)
C     NMONT  = NO. OF AIR MONITORING STATIONS (GE.3)
C     NSITES = NO. OF STATIONS WITH DATA
C     NYEAR  = NO. OF YEARS TO ANALIZE (EACH YEAR MUST HAVE BOTH POPLATI
C              ON AND AIR QUALITY DATA) (GE.1)
C     SYEAR  = INITIAL YEAR
C     DELYR  = INCREMEAL YEAR
C     NTIME  = NO. OF TIME CATEGORIES SUCH AS WEEKDAY AND WEEKEND (1 TO
C               6)
C     NRSA   = NO. OF REGIONAL STATISTICAL AREAS IN WHICH CURRE OR PRO
C               -JECTED POPULATION STATISTICS ARE AVAILABLE (GE.1)
C     NPOPL  = NO. OF POPULATION CLASS SUCH AS SCHOOL-AGE AND ELDERLY (
C               1 TO 7)
C     NOBS     = NO. OF POSSIBLE OBSERVATIONS, E.G., 8760 FOR ANNUAL HOUR
C     -LY CONCENTRATION PERCENTILI STATISTICS
C
C
C                       EXPLANATION OF INPUT DATA
C
C     AREA(I) = AREA OF EACH RSA IN SQ. MI.
C     POPCNT(I,J) =  SUBPOPLATION PER CENT OF TOTAL POPULATION AT EACH
C                    RSA IN 1970 OR OTHER CENSUS YEAR
C     IRECEP(I,J) = RECEPTOR IDEIFICATION NUMBER
C     RECEP (I,J) = X-Y COORDINATE OF EACH RECEPTOR
C     IRSA (I,J) = NO. OF RECEPTOR POINTS ASSIGNED TO A GIVEN RSA
```

```
C      ISITE(I)    = AIR MONITORING STATION I.D. NUMBER
C      SITE (I,J) = X-Y COORDINATE OF EACH STATION
C      POPL (I,J) =  TOTAL POPULATION AND TOTAL EMPLOYMENT AT EACH RSA
C                        IN EACH YEAR
C      CMF (I,J)  = PERCENTTILE CONCENTRATIONS OBSERBED AT EACH STATION
C                      IN EACH YEAR OR IN EACH TIME CATEGORY (SAME UNIT AS
C                      USED IN AQSTD)
C
C
C
C -- WHEN PENALTY DISTANCE IS USED (NPDIST=1) THE FOLLOWING
C      ARE REQUIRED -
C      MOUNTN = NO. OF GEOGRAPHICAL BARRIERS TO BE INCLUDED IN
C      SPATIAL INTERPOLATION
C      MNODE(I) = NO. OF NODES USED TO APPROXIMATE LOCATION OF EACH
C                 GEOGRAPHICAL BARRIER
C      X(I,J) AND Y(I,J) = X AND Y COORDINATES OF J-TH NODE OF I-TH
C              MOUNTAIN
C      P(I,J) = PENALTY DISTANCE ASSIGNED TO THE J-TH NODE OF I-TH
C             MOUNTAIN.
C
C
  100 FORMAT(1H1,25X,13A6///)
      READ(5,214)(TITLE(I),I=1,13)
  214 FORMAT(13A6)
      READ(5,210)NRECEP,NMONT,NSITES,NRSA,NPOPL,NHOUR,NYEAR,SYEAR,
     3DELYR,AQSTD,NPDIST
  210 FORMAT(4I5,5X,3I5,3F10.1,I5)
  200 FORMAT (5X,8HNRECEP =,I5,3X,6HNRSA =,I5,3X,7HNMONT =,I5,3X,
     1 8HNSITES =,I5,3X,7HNPOPL =,I3,3X,/,5X,7HNYEAR =,I5,5X,
     2 7HSYEAR =,F8.1,5X,7HDELYR =,F5.1,5X,7HAQSTD =,F7.1/)
      READ(5,211)XLOW,XINCR,NINCR
  211 FORMAT(2F10.0,I5)
      READ(5,216)(PTILE(I),I=2,8)
  216 FORMAT(7F5.1)
      WRITE (6,100)(TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
      WRITE(6,215)
  215 FORMAT (2X,' CENSUS DATA - PER CENT OF TOTAL POPULATION '//)
```

```
      DO 10 I=1,NRSA
      READ(5,220)(IDRSA(I,J),J=1,2),   AREA(I),(POPCNT(I,J),J=1,4)
  220 FORMAT (2I10,10X,5F10.1)
   10 CONTINUE
      DO 20 I = 1,NRECEP
      READ(5,230) (IRECEP(I,J),J=1,2),(RECEP(I,J),J=1,2)
  230 FORMAT(2I10,2F10.0)
   20 CONTINUE
      READ(5,240) (IRSA(I),I=1,NRSA)
 240  FORMAT((16I5))
      DO 11 I=1,NRSA
      WRITE(6,225)  I,(IDRSA(I,J),J=1,2),AREA(I),(POPCNT(I,J),J=1,4),
     1IRSA(I)
  225 FORMAT(2X,'NO. =',I3,3X,'SA =',2I5,5X,'AREA =',F7.1,5X,
     1'SUBPOP A,B,C,D (IN%) =',4F7.1,8X,'RECEPTORS PER SA =',I3)
   11 CONTINUE
      WRITE(6,100) (TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
      WRITE(6,245)
  245 FORMAT(30X,' AIR MONITORING STATIONS '//)
      DO 30 I = 1,NMONT
      READ(5,250) (ISITE(I,J),J=1,2),(SITE(I,J),J=1,2)
  250 FORMAT (2I10,2F10.0)
      WRITE(6,255) I,(ISITE(I,J),J=1,2),(SITE(I,J),J=1,2)
  255 FORMAT(2X,4HNO.=,I4,5X,'STATION NO =',2I5,10X,'X-Y COORDINATE =',
     32F10.0)
   30 CONTINUE
      IF(NPDIST.EQ.0)GO TO 1111
      READ(5,1001) MOUNTN,(MNODE(I),I=1,MOUNTN)
 1001 FORMAT(I2,20I3)
      DO 33 I=1,MOUNTN
      MND=MNODE(I)
      DO 32 J=1,MND
      READ(5,2001) X(I,J),Y(I,J),P(I,J)
 2001 FORMAT(3F8.2)
      P(I,J)=10. * P(I,J)
   32 CONTINUE
   33 CONTINUE
 1111 CONTINUE
```

```
C
C      END TIME INDEPENDE INPUT DATA AND START YEAR LOOP
C
       YEAR = SYEAR
       DO 40  NY = 1,NYEAR
       WRITE (6,100)(TITLE(I),I=1,13)
       WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
      + AQSTD
       WRITE (6,265) YEAR
  265 FORMAT (20X,' POPULATION DATA - TOTAL POPULATION AND ALL WORKERS B
     3Y WORK PLACE (', F8.1,3H )//)
        DO 50 I=1,NRSA
        READ (5,260) (IDRSA(I,J), J=1,2),  (POPL(I,J), J= 1,2)
  260   FORMAT(2I10,2F10.0)
        WRITE (6,275) I,(IDRSA(I,J), J=1,2),(POPL(I,J), J=1,2)
  275   FORMAT(3X,'NO. =', I3,5X,'SA =',2X,2I3,5X'TOTAL POP.= ', F10.0, 10X,
     3'ALL WKRS BY',   ' WK-PLACE=',F10.0)
   50   CONTINUE
        WRITE (6,100)(TITLE(I),I=1,13)
       WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
      + AQSTD
        WRITE (6,285) YEAR
  285  FORMAT (30X,'RECEPTOR SPECIFICATION DATA FOR ',F6.1//)
        TAREA =0.
        DO 60 I= 1,NRECEP
        KRSA = IRECEP(I,1)
        NN = IRSA(KRSA)
        IF (NN.LE.0) GO TO 60
   61   AWT(I) = AREA(KRSA)/NN
       RPOPL(I,1) = POPL(KRSA,1)/NN
       RPOPL(I,2) = POPL(KRSA,2)/NN
       TAREA = TAREA + AWT(I)
        WRITE (6,295)I,KRSA,IRECEP(I,2),(RECEP(I,J), J=1,2),(RPOPL(I,J),
     3  J=1,2),AWT(I)
  295   FORMAT (2X,4HNO.=,I5,3X,'RECEPT NO. =',2I5,5X,'X-Y COORD =',
     22F10.0,5X,'TPOPL - WKRPL'
     3  ,2H =,F10.0,F7.0,3X,'AREA =',F10.1)
   60   CONTINUE
C
C       START TIME CATEGORY LOOP
```

```
C
      IF(NHOUR.EQ.1)GO TO 441
      IF(NHOUR.EQ.24)GO TO 442
  441 NH=0
      GO TO 443
  442 NH=6
  443 CONTINUE
      NH=NH+1
      NOBS=IOBS(NH)
        WRITE (6,100)(TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
        WRITE (6,305) YEAR,(PTILE(I),I=2,8)
  305   FORMAT (20X,'FREQUENCY DISTRIBUTION OF MONITORED CONCENTRATION '
     3  ,5X,6HYEAR =,F7.1,/,1X,'P1 P2 P3 P4 P5 P6 P7 P8 = 100/(N+1)'
     4 ,7F5.1/)
C
C       START READING AIR QUALITY DATA
C
      DO 80 I=1,NSITES
      READ(5,270)IN,KN,(CMF(IN,J),J=1,8)
  270 FORMAT(I5,I5,6X,8F8.2)
          WRITE (6,315) I,(ISITE(IN,J),J=1,2),(CMF(IN,J),J=1,8)
  315     FORMAT (2X,I3,3X,'ST. ID NO. =',2I5,5X,'MAX,P2,P3,P4,P5,P6,P7,P8
     3'      ,' %ILE =',8F8.1)
   80     CONTINUE
C
C       START COMPUTING PERCENTILE CONCENTRATION AT EACH RECEPTOR BY
C       USING AN INTERPOLATION FORMULA
C
        WRITE(6,100)(TITLE(I),I=1,13)
      WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
     + AQSTD
        WRITE(6,325) YEAR
  325   FORMAT (20X,'INTERPOLATED - EXTERPOLATED PERCENTILE CONCEN',
     3  'RATIONS AT RECEPTOR SITES',5X,6HYEAR =,F7.1,5X//)
        CALL FRQNCY
C
C       START COMPUTING RISK PROBABILITIES AT EACH RECEPTOR ASSOCIATED
C       WITH AIR QUALITY STANDARDS
```

```
      WRITE(6,100)(TITLE(I),I=1,13)
     WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
    + AQSTD
      WRITE(6,335)  YEAR
  335 FORMAT (15X,'RISK OF RECEPTOR CONCENTRATION EXCEEDING ',
     3  'MULTIPLES OF AQSTD',5X,6HYEAR =,F7.1,5X//)
      CALL RISKDN
C
C     START POPULATION CLASS LOOP
C
C     POPULATION CLASS = 1  FOR TOTAL POPULATION
C     POPULATION CLASS = 2 FOR SCHOOL AGE POPULATION
C     POPULATION CLASS = 3  FOR ELDERLY POPULATION
C     POPULATION CLASS = 4  FOR NON-WHITE POPULATION
C     POPULATION CLASS = 5  ALL WORKERS BY RESIDENCE.
C     POPULATION CLASS = 6  ALL NON-WORKERS BY RESIDENCE
C     POPULATION CLASS = 7  ALL WORKERS BY WORK PLACE
C
81    M=MIN0(7,NPOPL)
        DO 90  NP = 1,M
        TPOPL = 0.
          DO 95 I = 1,NRECEP
          K = IRECEP(I,1)
          TOTALP = RPOPL(I,1)
          GO TO (91,92,93,94,97,98,99),NP
   91     DENSTY (I) = TOTALP
          GO TO 96
   92     DENSTY (I) = TOTALP * PCENT(K,1)/100.
          GO TO 96
   93     DENSTY (I) = TOTALP * PCENT(K,2)/100.
          GO TO 96
   94     DENSTY (I) = TOTALP *POPCNT(K,3)/100.
          GO TO 96
   97     DENSTY(I)=TOTALP*POPCNT(K,4)/100.
          GO TO 96
   98     DENSTY(I)=TOTALP*(100.-POPCNT(K,4))/100.
          GO TO 96
   99     DENSTY(I)=RPOPL(I,2)
   96     TPOPL = TPOPL + DENSTY(I)
   95     CONTINUE
```

C

```
                 WRITE (6,100)(TITLE(I),I=1,13)
             WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
           + AQSTD
                 WRITE (6,345) YEAR,NP,TPOPL,TAREA,(PTILE(I),I=2,8)
       345       FORMAT(10X,'CONCENTTATION FUNCTIONS FOR DATA SET   ',6HYEAR =,
          3      F8.1,3X,9HPOPL CL =,I2,3X,7HTPOPL =,F10.0,5X,4HTAREA,
          3      3HA =,F10.0,/,1X,'P1 P2 P3 P4 P5 P6 P7 P8 = 100/(N+1)',7F5.1)
                 CALL DSPCTR
                 WRITE (6,100)(TITLE(I),I=1,13)
             WRITE(6,200)NRECEP,NRSA,NMONT,NSITES,NPOPL,NYEAR,SYEAR,DELYR,
           + AQSTD
                 WRITE (6,355) YEAR,NP,TPOPL,TAREA
       355       FORMAT (10X,'RISK FUNCTIONS FOR DATA SET   ',6HYEAR =,F8.1,3X,
          3      9HPOPL CL =,I2,3X,7HTPOPL =,F10.0,5X,4HTAREA,
          3      3HA =,F10.0//)
                 CALL RSPCTR
  C                                                                   POTS
        90       CONTINUE
        70     CONTINUE
             YEAR = YEAR + DELYR
        40   CONTINUE
             STOP
             SUBROUTINE SEARCH
             COMMON   AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
            1SITE(200,2),CMF(200,8),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPO
            2PL,CFRQ(300,8),F(300,4),NOBS, XLOW,XINCR,NINCR,PTILE(8)
             M=NMONT-1
             DO 100 I=1,M
             K=I+1
             DO 100 J=K,NMONT
             IF(RANK(I)-RANK(J)) 100,100,10
  C          SORT THE DISTANCES TO MONITORING STATIONS IN ASCENDING ORDER
        10   ADJUST=RANK(I)
             RANK(I)=RANK(J)
             RANK(J)=ADJUST
  C          ORDER THE MONITORING STATION NUMBERS ACCORDINGLY
             IAJUST=NSITE(I)
             NSITE(I)=NSITE(J)
             NSITE(J)=IAJUST
       100   CONTINUE
```

```
      RETURN
      SUBROUTINE RSPCTR
      COMMON  AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMF(200,8),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPO
     2PL,CFRQ(300,8),F(300,4),NOBS , XLOW,XINCR,NINCR,PTILE(8)
      DIMENSION RTHR(30),RI(4),PRI(4),PRKA(4),PRKP(4),RKASR(4),RKPSR(4)
     3,SASR(4),SPSR(4)
      DATA RTHR /100.,90.,80.,70.,60.,50.,45.,40.,35.,30.,
     3           25.,20.,15.,12.5,10.,7.5,5.,3.,1.,.75,.5,.3,.1,0.0/
      NRTHR = 24
      WRITE (6,200)
  200 FORMAT(10X,'DISTRIBUTION AND FREQUENCY FUNCTIONS',
     1' OF RISK AREA AND RISK POPULATION'//)
      WRITE(6,209)
  209 FORMAT(40X,'LAND AREA',40X,'POPULATION',/,2X,'% TIME',14X,2('DISTR
     1IBUTION FUNCTION',5X,'FREQUENCY FUNCTION',5X),/,2X,'ABOVE',18X,4(
     2'THRESHOLD',17X))
  210 FORMAT(1X,'THRESHOLD',8X,4(5H1 STD,1X,5H2 STD,1X,5H3 STD,1X,5H4 ST
     1D,3X)/)
      WRITE (6,210)
      DO 20 J=1,4
      RI(J) = 0.
      PRI(J) = 0.
      PRKA(J) = 0.
      PRKP(J) = 0.
   20 CONTINUE
      PTHR = 100.
C
C     END INITIALIZATION AND START F* LOOP
      DO 30 K=1,NRTHR
      DELF = PTHR - RTHR(K)
C
C     START FS LOOP
C
        DO 40 J = 1,4
        RA = 0.
        RP = 0.
          DO 50 I = 1,NRECEP
          IF(F(I,J).LT.RTHR(K)) GO TO 50
          RA = RA + AWT(I)
```

```
                 RP = RP  + DENSTY(I)
         50      CONTINUE
              RKASR(J) = RA/TAREA
              RKPSR(J) = RP/TPOPL
              SASR(J) = (RKASR(J)-PRKA(J))
              SPSR(J) = (RKPSR(J)-PRKP(J))
              RI(J) = RI(J) + 0.5*(RKASR(J) + PRKA(J))*DELF
              PRI(J) = PRI(J) + 0.5*(RKPSR(J)+ PRKP(J))*DELF
              PRKA(J) = RKASR(J)
              PRKP(J) = RKPSR(J)
        40    CONTINUE
            WRITE(6,221)RTHR(K),(RKASR(J),J=1,4),(SASR(J),J=1,4),(RKPSR(J),J=1
           1,4),(SPSR(J),J=1,4)
        221 FORMAT(2X,'F* =',F5.1,5X,4(4F6.3,2X))
      C                                                                    )1(RSPKR,).K(RHTR)51(ETIRW
            PTHR = RTHR(K)
        30 CONTINUE
      C
      C     END F* LOOP
      C
            WRITE (6,240) (RI(J),J=1,4), (PRI(J),J=1,4)
        240 FORMAT(//11X,'AVERAGE LAND AREA RISK (IN%) =',4F6.2,/,62X,'AVERAGE
           2 POPULATION RISK (IN%) =',4F6.2)
      C     ENDFILE OUTPUT AFTER A BUNCH OF CURVES
            RETURN
            SUBROUTINE FRQNCY
            COMMON   AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
           1SITE(200,2),CMF(200,8),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPO
           2PL,CFRQ(300,8),F(300,4),NOBS, XLOW,XINCR,NINCR,PTILE(8)
            DIMENSION XM(300),YM(300)
            DIMENSION S(2),R(2)                                                    FO    13
            DIMENSION SS(2),CORD(2),CORDI(2),XS(200),YS(200),XN(10,100),YN(10,FO    14
           1 100)                                                                  FO    14
            COMMON MNODE(100),X(10,100),Y(10,100),P(10,100),MOUNTN,NPDIST          FO    15
            DIMENSION XX(10,100),YY(10,100)                                        FO    17
            MVALID=0
            DO 10 I=1,NMONT
            XM(I)=SITE(I,1)
            YM(I)=SITE(I,2)
        10 CONTINUE
```

```
             WRITE(6,101) (PTILE(I), I=2,8)
        101  FORMAT(/1X,'P1 P2 P3 P4 P5 P6 P7 P8 = 100/(N+1)',/F5.1/)
             DO 20 N=1,NRECEP
             XR=RECEP(N,1)
             YR=RECEP(N,2)
             R(1)=XR                                                  FO      26
             R(2)=YR                                                  FO      27
             IF(NPDIST.EQ.0)GO TO 1111                                FO      28
       C     DO(I=1,MOUNTN)                                           IF      29
             DO 19999 I=1,MOUNTN                                              29
               MND=MNODE(I)                                           FO 1    30
       C       DO(J=1,MND)                                            IF 1    31
               DO 19998 J=1,MND                                               31
                 CORD(1)=X(I,J)                                       FO 2    32
                 CORD(2)=Y(I,J)                                       FO 2    33
                 CALL TRNSLT(CORD,R,CORD1)                            FO 2    34
                 XX(I,J)=CORD1(1)                                     FO 2    35
                 YY(I,J)=CORD1(2)                                     FO 2    36
       C       END DO                                                 IF 1    37
       19998   CONTINUE                                                       37
       C     END DO                                                   IF      38
       19999 CONTINUE                                                         38
       1111  CONTINUE                                                 FO      39
             DO 30 I=1,NMONT
             CHECK=CMF(I,1)
             IF(CHECK) 51,51,52
          51 DIST=9.9E10
             GO TO 53
          52 XDIST=XM(I)-XR
             YDIST=YM(I)-YR
             DIST=SQRT(XDIST*XDIST+YDIST*YDIST)
             IF(NPDIST.EQ.0)GO TO 1112                                FO      48
             S(1)=XM(I)                                               FO      49
             S(2)=YM(I)                                               FO      50
             CALL TRNSLT(S,R,SS)                                      FO      51
       C AFTER ROTATION THE STATION POINT IS ON THE X DOUBLE PRIME AXIS FO    52
             XS(I)=DIST                                               FO      53
             YS(I)=0.0                                                FO      54
       C FIND THE COORDINATE OF EACH MOUNTAIN NODE IN THE DOUBLE PRIMED SYSTEM FO 55
             THETA=ATAN2(SS(2),SS(1))                                 FO      56
```

```
400      C       DO(J=1,MOUNTN)                                                  IF     57
401              DO 19997 J=1,MOUNTN                                                    57
402                MND=MNODE(J)                                                  FO 1   58
403      C         DO(K=1,MND)                                                   IF 1   59
404                DO 19996 K=1,MND                                                     59
405                  XN(J,K)=XX(J,K)*COS(THETA)+YY(J,K)*SIN(THETA)               FO 2   60
406                  YN(J,K)=-XX(J,K)*SIN(THETA)+YY(J,K)*COS(THETA)              FO 2   61
407      C         END DO                                                        IF 1   62
408      19996     CONTINUE                                                             62
409      C       END DO                                                          IF     63
410      19997 CONTINUE                                                                 63
411      C TEST WHETHER EACH MOUNTAIN NODE IS ON THE X DOUBLE PRIME AXIS AND BETWFO      64
412      C STATION AND RECEPTOR POINTS                                           FO     65
413      C       DO(J=1,MOUNTN)                                                  IF     66
414              DO 19995 J=1,MOUNTN                                                    66
415                MND=MNODE(J)                                                  FO 1   67
416      C         DO(K=1,MND)                                                   IF 1   68
417                DO 19994 K=1,MND                                                     68
418      C           IF(YN(J,K).EQ.0.0.AND.XN(J,K).LE.DIST.AND.XN(J,K).GT.0.0)   IF 2   69
419                  IF(                                                                69
420           *      YN(J,K).EQ.0.0.AND.XN(J,K).LE.DIST.AND.XN(J,K).GT.0.0             69
421           *      ) GO TO 19991                                                      69
422                  GO TO 19992                                                        69
423      19991       CONTINUE                                                           69
424                    DIST=DIST+P(J,K)                                          FO 3   70
425      C           END IF                                                      IF 2   71
426      19992       CONTINUE                                                           71
427      19993       CONTINUE                                                           71
428      C         END DO                                                        IF 1   72
429      19994     CONTINUE                                                             72
430      C       END DO                                                          IF     73
431      19995 CONTINUE                                                                 73
432      C TEST WHETHER THE STATION-RECEPTOR LINE CROSS ANY MOUNTAIN REGION      FO     74
433      C       DO(J=1,MOUNTN)                                                  IF     75
434              DO 19990 J=1,MOUNTN                                                    75
435                M1=MNODE(J)-1                                                 FO 1   76
436      C         DO(K=1,M1)                                                    IF 1   77
437                DO 19989 K=1,M1                                                      77
438      C           IF(XN(J,K).EQ.XN(J,K+1))                                    IF 2   78
439                  IF(XN(J,K).EQ.XN(J,K+1)) GO TO 19986                               78
```

D

```
                GO TO 19987                                                  78
      19986     CONTINUE                                                     78
      C           IF(XN(J,K).LE.XS(I))                              IF 3    79
                  IF(XN(J,K).LE.XS(I)) GO TO 19983                           79
                  GO TO 19984                                                79
      19983       CONTINUE                                                   79
      C             IF (YN(J,K)*YN(J,K+1).LT.0.0)                   IF 4    80
                    IF (YN(J,K)*YN(J,K+1).LT.0.0) GO TO 19980                80
                    GO TO 19981                                              80
      19980         CONTINUE                                                 80
                      PENL=P(J,K)+(P(J,K+1)-P(J,K))*ABS(YN(J,K))/(ABS(YN(J,K))FO 5   81
           *+ABS(YN(J,                                                       81
            1           K+1)))                                      FO      81
                      DIST=DIST+PENL                                FO 5    82
      C             END IF                                          IF 4    83
      19981         CONTINUE                                                 83
      19982         CONTINUE                                                 83
      C           END IF                                            IF 3    84
      19984       CONTINUE                                                   84
      19985       CONTINUE                                                   84
      C         ELSE                                                IF 2    85
                GO TO 19988                                                  85
      19987     CONTINUE                                                     85
      C           IF(YN(J,K)*YN(J,K+1).LT.0.0)                      IF 3    86
                  IF(YN(J,K)*YN(J,K+1).LT.0.0) GO TO 19977                   86
                  GO TO 19978                                                86
      19977       CONTINUE                                                   86
                    SLOPE=(YN(J,K)-YN(J,K+1))/(XN(J,K)-XN(J,K+1))   FO 4    87
      C             IF (SLOPE.NE.0.0)                               IF 4    88
                    IF (SLOPE.NE.0.0) GO TO 19974                            88
                    GO TO 19975                                              88
      19974         CONTINUE                                                 88
                      XINTCP=XN(J,K)-YN(J,K)/SLOPE                  FO 5    89
      C               IF (XINTCP.LE.XS(I).AND.XINTCP.GT.0.0)        IF 5    90
                      IF (XINTCP.LE.XS(I).AND.XINTCP.GT.0.0) GO TO 19971     90
                      GO TO 19972                                            90
      19971           CONTINUE                                               90
                        PENL=P(J,K)+(P(J,K+1)-P(J,K))*ABS(YN(J,K))/(ABS(YN(J,KFO 6   91
           *))+ABS(YN(J,                                                     91
            1             K+1)))                                    FO      91
```

```
                        DIST=DIST+PENL                          FO 6   92
      C                END IF                                   IF 5   93
      19972            CONTINUE                                        93
      19973            CONTINUE                                        93
      C              END IF                                     IF 4   94
      19975          CONTINUE                                          94
      19976          CONTINUE                                          94
      C            END IF                                       IF 3   95
      19978        CONTINUE                                            95
      19979        CONTINUE                                            95
      C          END IF                                         IF 2   96
      19988      CONTINUE                                              96
      C        END DO                                           IF 1   97
      19989    CONTINUE                                                97
      C      END DO                                             IF     98
      19990 CONTINUE                                                   98
      1112  CONTINUE                                            FO     99
            IF (N.NE.1) GO TO 53
            MVALID=MVALID+1
         53 RANK(I)=DIST
            NSITE(I)=I
         30 CONTINUE
            IF(N.NE.1) GO TO 99
            WRITE(6,190) MVALID
        190 FORMAT(5X,'NO. OF VALID MONITORING STATIONS= ',I4/)
         99 CALL SEARCH
            DO 40 J=1,8
            TD=0.
            TC=0.
            DO 50 K=1,3
            M=NSITE(K)
            D=RANK(K)
            IF(D.LT.EPS) GO TO 55
            FWT=1./D**2
            TD=TD+FWT
            TC=TC+FWT*CHF(M,J)
         50 CONTINUE
            CFRQ(N,J) = TC/TD
            GO TO 40
         55 CFRQ(N,J)=CHF(M,J)
```

```
   40 CONTINUE
      WRITE(6,110) N,(CFRQ(N,J),J=1,8)
  110 FORMAT(2X,'NO.=',I4,5X,' MAX,P2,P3,P4,P5,P6,P7,P8 P-TILE =',
     3 8F10.1)
   20 CONTINUE
      RETURN
      SUBROUTINE TRNSLT(CORD1,ORIGIN,CORD2)
      DIMENSION CORD1(2),ORIGIN(2),CORD2(2)
      DO 100 I=1,2
      CORD2(I)=CORD1(I)-ORIGIN(I)
  100 CONTINUE
      RETURN
      SUBROUTINE DSPCTR
      COMMON / LUPLCM / LUPLT
      COMMON  AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMF(200,8),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPO
     2PL,CFRQ(300,8),F(300,4),NOBS , XLOW,XINCR,NINCR,PTILE(8)
      DIMENSION DTHR(40),AQS(3),PQS(3),PSAR(3),PSPP(3),DA(3),DP(3),CHEK
     3(3), POPAVG(3), AREAVG(3),DSAR(3),DSPP(3),ASPC(3),PSPC(3)
      DO 25 I= 1, NINCR
   25 DTHR(I) = XLOW + XINCR * (NINCR-I)
      WRITE(6,215)
  215 FORMAT(/20X,'POPULATION AND LAND AREA EXPOSURE FUNCTIONS',//,40X,
     1'LAND AREA',40X,'POPULATION',/,22X,2('DISTRIBUTION FUNCTION',5X
     2'FREQUENCY FUNCTION',5X),/,17X,4(13X,'PERCENTILE'),/1X,'CONCENT'
     3,'RATION',13X,4('P2      P5      P7',7X))
C
C     COMPUTE A(D*), P(D*), SA(D*), SP(D*) FOR 50TH, 90TH,99TH PERCENTI
C     LE
      DO 10 N=1,3
      AQS(N) =0.
      PQS(N) =0.
      PSAR(N) =0.
      PSPP(N) = 0.
   10 CONTINUE
      PTHR = DTHR(1) + XINCR
C     END INITIALIZATION AND START D* LOOP
      DO 20 J =1,NINCR
        DO 30 N = 1,3
        DA(N) =0.
```

```
               DP(N)=0.
   30          CONTINUE
C           END INITIALIZATION AND START RECEPTOR LOOP
C
               DO 40 I=1,NRECEP
                  DO 50 N=1,3
                  GO TO (31,32,33),N
   31             K=7
                  GO TO 34
   32             K=5
                  GO TO 34
   33             K=2
   34             CHEK(N) = CFRQ(I,K)- DTHR(J)
                  IF (CHEK(N)) 41,42,42
   41             SIGN = 0.
                  GO TO 43
   42             SIGN = 1.
   43             DA(N) = DA(N) + SIGN * AWT(I)
                  DP(N) = DP(N) + SIGN * DENSTY(I)
   50 CONTINUE
   40          CONTINUE
               DELC = PTHR - DTHR(J)
               DO 60 N=1,3
            DSAR(N) = DA(N)/TAREA
               DSPP(N) = DP(N)/TPOPL
               ASPC(N) = DSAR(N) - PSAR(N)
               PSPC(N) = DSPP(N) - PSPP(N)
               AQS(N) = AQS(N) + 0.5*(DSAR(N)+PSAR(N))*DELC
               PQS(N) = PQS(N) + 0.5*(DSPP(N)+PSPP(N))*DELC
               PSAR(N) = DSAR(N)
               PSPP(N) = DSPP(N)
   60          CONTINUE
               PTHR = DTHR(J)
            WRITE(6,221)DTHR(J),(DSAR(N),N=1,3),(ASPC(N),N=1,3),(DSPP(N),N=1,3
          1),(PSPC(N),N=1,3)
  221       FORMAT(2X,'D* =',F6.1,10X,4(F7.3,2X))
   20       CONTINUE
            DO 21 I= 1,3
            AQS(I) = AQS(I) + DTHR(NINCR)
   21       PQS(I) = PQS(I) + DTHR(NINCR)
```

```
      DO 23 J= 1,3
      POPAVG(J) = 0.
      AREAVG (J) = 0.
      GO TO (51,52,53),J
   51 K = 7
      GO TO 54
   52 K = 5
      GO TO 54
   53 K = 2
   54 CONTINUE
      DO 22 I = 1,NRECEP
      POPAVG(J) = POPAVG(J) + CFRQ(I,K) * DENSTY(I)
      AREAVG(J) = AREAVG(J) + CFRQ(I,K) * AWT(I)
  22  CONTINUE
       POPAVG(J) = POPAVG(J)/TPOPL
      AREAVG(J) = AREAVG(J)/TAREA
  23  CONTINUE
      WRITE (6,240) (AREAVG(N), N=1,3), (POPAVG(N),N=1,3)
C
C     END RECEPTOR LOOP
C
  240 FORMAT(/17X,'SPATIAL AVERAGE AIR QUALITY = ',3F7.2,/,51X,'POPULAT'
     1,'ION WEIGHTED AVERAGE AIR QUALITY = ',3F7.2)
      RETURN
      SUBROUTINE RISKDN
      COMMON  AQSTD,NRECEP,NMONT,EPS,RECEP(300,2),NSITE(200),RANK(200),
     1SITE(200,2),CMF(200,8),RPOPL(300,2),AWT(300),DENSTY(300),TAREA,TPO
     2PL,CFRQ(300,8),F(300,4),NOBS, XLOW, XINCR, NINCR,PTILE(8)
      DIMENSION STD(4)
      STD(1) = AQSTD
      STD(2) = AQSTD * 2.
      STD(3) = AQSTD * 3.
      STD(4) = AQSTD * 4.
      DO 10 I=1,NRECEP
C
C      COMPUTE FS FOR A GIVEN CS AT EACH RECEPTOR POINT
C
      DO 20 J=1,4
        K = 1
        IF (STD(J) - CFRQ(I,K))  12,11,11
```

D

```
 11   F(I,J) = 0.
      GO TO 20
 12   CHECK = (CFRQ(I,K) -STD(J)) * (CFRQ(I,K+1) - STD(J))
      IF(CHECK) 30,30,21
 21   K = K + 1
      IF (K - 8) 12,22,22
 22   F(I,J) = 100.
      GO TO 20
 30   CU = CFRQ (I,K)
      CL = CFRQ (I,K+1)
     IF(K.EQ.1) GO TO 42
 41 PU=FLOAT(PTILE(K))
     GO TO 43
42   PU=100./NOBS
43   PL=FLOAT(PTILE(K+1))
      IF (CU - CL)  32,31,32
 31   F(I,J) = (PL + PU)/2.
      GO TO 20
 32 ROGF=((CU-STD(J))*ALOG(PL) + (STD(J) - CL)*ALOG(PU))/(CU - CL)
     F(I,J) = EXP(ROGF)
 20   CONTINUE
     X=RECEP(I,1)
     Y=RECEP(I,2)
     Z=F(I,1)
     WRITE(8,88) F(I,1),RECEP(I,1),RECEP(I,2)
88   FORMAT(3F10.1)
     WRITE (6,200)  I,(F(I,J),J=1,4)
200 FORMAT (2X,'RECEPTOR NO.=',I4,5X,'1 STD RISK = ', F5.1,5X,'2 STD RI
   3SK = ', F5.1,5X,'3 STD RISK = ', F5.1,5X,'4 STD RISK = ', F5.1)
 10 CONTINUE
     RETURN
     END
```

```
TRRP*POPEXP,HYBRID
      DIMENSION IBUF(1000),XPOLYG(60,25),YPOLYG(60,25),NPTS(25)
      DIMENSION X(60),Y(60)
      DIMENSION SYMBL(10),RANGE(9)
      DIMENSION DATA(247,10),XX(247,10),YY(247,10)
      DIMENSION NRECPT(10)
      READ (5,94) XFACT, XOFF,YOFF, XWIDTH,CHAR,NPLOT1,NPLOT2
   94 FORMAT(5F5.1,3I5)
      IF(NPLOT1.EQ.0)NPLOT1=1
      IF(NPLOT2.EQ.0)NPLOT2=1
      IF(CHAR.EQ.0.)CHAR=1.
      SIZE=0.10*CHAR/XFACT
      READ(5,6)(SYMBL(I),I=1,10)
    6 FORMAT(10A1)
      READ(5,4)(RANGE(I),I=1,9)
      READ(5,1)NPOLYG,(NPTS(I),I=1,NPOLYG),
      DO 10 J=1,NPOLYG
      N=NPTS(J)
      READ(5,2)((XPOLYG(I,J),YPOLYG(I,J)),I=1,N)
      DO 15 I=1,N
      XPOLYG(I,J) = XPOLYG(I,J)-XOFF
      YPOLYG(I,J) = YPOLYG(I,J)-YOFF
   15 CONTINUE
   10 CONTINUE
    1 FORMAT(40I2)
    2 FORMAT(2F10.1)
    4 FORMAT(9F5.1)
      DO 20 K=1,NPLOT2
      READ(5,5)NRECPT(K)
      NK=NRECPT(K)
    5 FORMAT(I3)
      READ(5,3)((DATA(I,K),XX(I,K),YY(I,K)),I=1,NK)
      DO 20 I=1,NK
      XX(I,K) = XX(I,K)-XOFF-.10*CHAR
```

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```
   20 YY(I,K) = YY(I,K)-YOFF-.10*CHAR
      CALL PLOTS(IBUF,1000,14)
      CALL FACTOR (XFACT)
      CALL PLOT(0.0,0.,-3)
      DO 260 K=NPLOT1,NPLOT2
       NK=NRECPT(K)
      DO 100 J=1,NPOLYG
      N=NPTS(J)
      CALL PLOT(XPOLYG(1,J),YPOLYG(1,J),3)
      DO 105 I=1,N
      X(I)=0.
      Y(I)=0.
      X(I)=XPOLYG(I,J)
      Y(I)=YPOLYG(I,J)
  120 CALL PLOT(X(I),Y(I),2)
  105 CONTINUE
      CALL PLOT(X(1),Y(1),2)
  100 CONTINUE
    3 FORMAT(3F10.1)
      DO 250 I=1,NK
      IF(DATA(I,K).LT.RANGE(9))Z=SYMBL(10)
      DO 251 J=9,1
      IF(DATA(I,K).GE.RANGE(J))Z=SYMBL(J)
  251 CONTINUE
      CALL SYMBOL(XX(I,K),YY(I,K),SIZE,Z,0.,1)
  250 CONTINUE
      CALL PLOT(XWIDTH,0.0,-3)
  260 CONTINUE
  110 CALL PLOT(XWIDTH,0.0,999)
      STOP
      END
>
```